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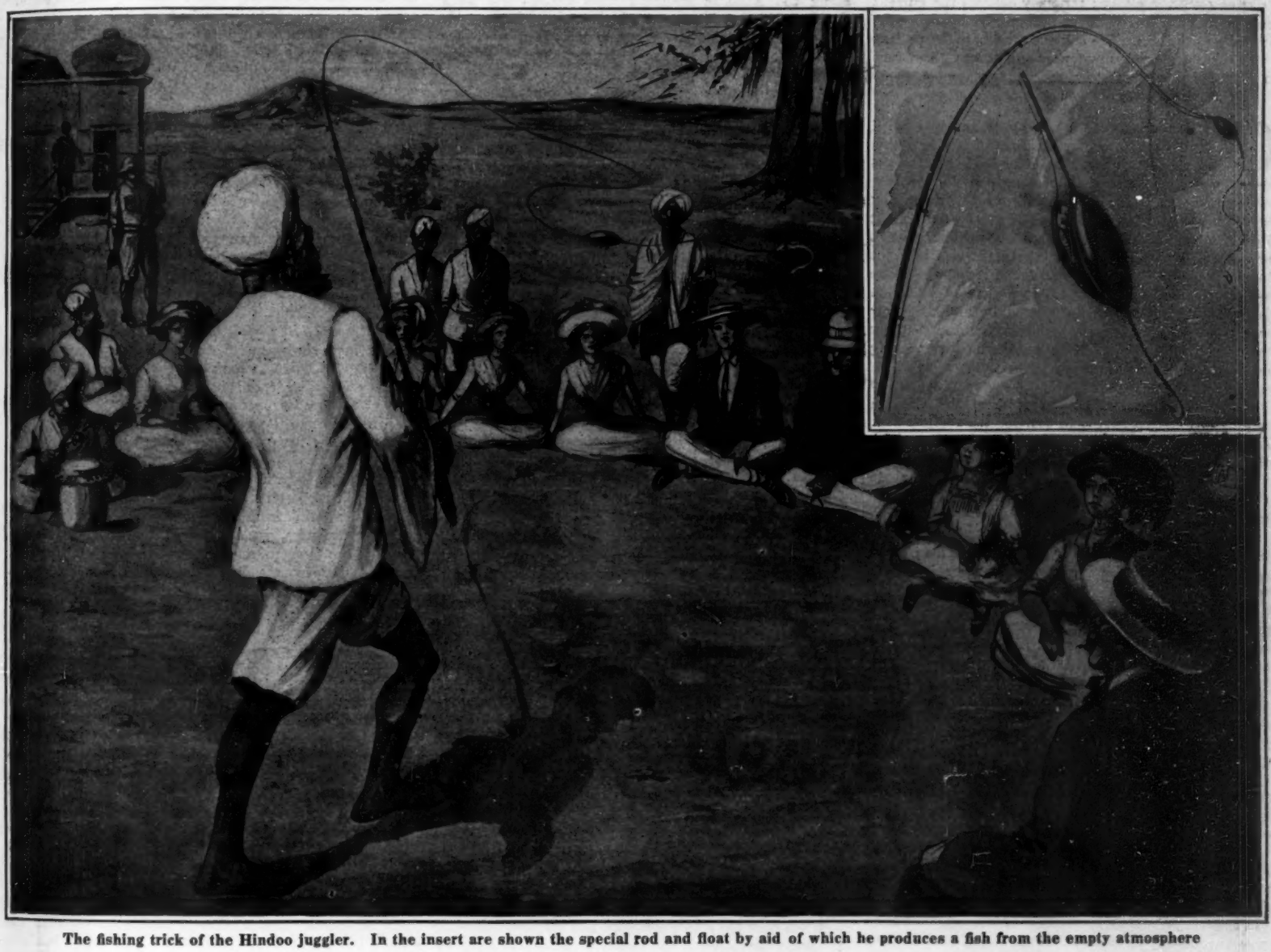

The fishing trick of the Hindoo juggler. In the insert are shown the special rod and float by aid of which he produces a fish from the empty atmosphere

How the Hindoo Juggler Catches Fish from the Air

By Prince Sarath Ghosh, F. R. A. S.

MANY are the tales that are told concerning the prowess of the Hindoo jugglers. Many are the explanations offered to resolve the mysterious feats they perform. To what extent the reputation enjoyed by these workers is a false one need not be discussed here; it cannot be gainsaid that they do stage many very clever and interesting feats. Some of these are confessedly on a par with the repertoire of the occidental magician, depending upon special apparatus, the aid of a confederate, and the manual skill of the prestidigitateur —"the hand is quicker than the eye." Others purport to be a direct exhibition of supernatural powers, and appear to be explicable only on this hypothesis or on that of hypnotism. But whatever the basis underlying the majority of the tricks, the one which is described here is one of deception, pure and simple.

Now it is not very hard to deceive the senses and the intelligence of the spectator. The latter thinks that, watching the trick proceed, he has all the elements, and that it is only necessary to piece them together, as in attempting to forecast the end of a detective story. This is perhaps true; but he overlooks the important fact that he has no idea which of the things he sees are essential, which non-essential. He does not know, unless he has seen a given trick performed many times, whether two acts that may or may not be vital to its success are always done in the same order or not. He does not know whether the succession of tricks is always the same, and so can not guess how many of the movements that are meaningless in connection with the feat during which they occur have a bearing upon subsequent portions of the exhibition. So he does not have quite so complete a collection of data as he had supposed; and it is not surprising if he is taken in by what seems, when set forth in cold type, a rather childish deception.

The trick illustrated on this page is a case in point. It comes early in the program—must of necessity come early in the program. If you were a spectator, would you attach any importance to the fact that, when the juggler undertakes to go fishing in the air above your head and catch a fat fish there, this trick is preceded only by one or two trivial bits of jugglery? If you saw the trick a second time, and it then occupied the same position in the program, but the trivial items coming ahead of it were different from what they had been before, is it at all likely that you would note any connection between the two occasions? Hardly; yet, as suggested, this trick must come early; for if we are going to catch a fish on dry land, we are not going to believe that the fish was elsewhere than on dry land waiting to be caught —and there is a very definite limit to the length of time that a fish will survive on dry land.

But to the business of the trick. After one or two brief minor features of the performance, the assistant brings out a long fishing rod. Like all well-ordered fishing rods, it has a float and a hook. The float is a pretty large float—perhaps eight inches long and two inches wide. It is attached about four feet above the hook. As shown in the picture, the main line has attached to it several small rings, and through these is threaded a secondary line, much smaller than the other, and running only to the float. The juggler dangles the rod before the spectators and shakes the hook in their faces. He plays it above their heads, and they watch the hook intently. He raises the hook higher and higher, extending the line as far as possible—to suggest the idea that the fish can not possibly come from him. He wriggles and snaps the line, and the onlookers see hook and float dancing merrily in the air. With a sudden throw the juggler casts the line to its maximum range, and jerks it back; there is a flash of silvery scales, and as the line comes to rest, the spectators see at its end a small fish—some six inches long. The performer lowers his catch into a bowl of water that has been placed in the center of the group by his assistant, and the latter hastens to release the fish, which swims merrily about in the bowl. Meanwhile the juggler puts the line away and clears the stage for the next number.

The explanation is not a hard one—especially when we have all the factors set down in black and white, so that we can go back over them accurately. Of course the fish came from the float. In fact, the float is hollow, hinged at the top, so that it can open out into two parts downward along its edge, if the catch at the bottom were released. And the float contains the fish from the *beginning*. He is hooked to the end of the thin subsidiary line, which, after leaving the fish's mouth near the hinge at the top of the float, runs down to the catch at the bottom of the float, and then up along the rod to the juggler's hand.

When the performer cast the line and jerked it back,

(*Continued on page 363*)

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Delay Due to Strikes

On several occasions this year strikes affecting our printing plant have made it impossible to issue the SCIENTIFIC AMERICAN on schedule time. The latest strike of over a week, has seriously delayed the current number and that of October 26th, and may delay the November 9th issue. We ask our readers to be patient under these trying circumstances and assure them that no effort is being spared to make up the lost time.

Peace by Correspondence

ONCE upon a time a worthy citizen was haled into court to answer a charge of having stolen his neighbor's pig. He defended himself vigorously, basing his claim of innocence upon five separate counts: first, that the plaintiff had never owned a pig; second, that the defendant had no pig in his possession; third, that the pig in the defendant's possession was not the plaintiff's pig; fourth, that the defendant had not stolen the plaintiff's pig, but had found it at large in the public highway, had removed it to a place of safety on his premises, had fed and sheltered it, and was now merely holding it against payment for the services rendered; fifth, that the defendant had eaten the pig and that there was accordingly no evidence upon which to prosecute him.

When this issue reaches our readers, the German reply to Mr. Wilson's reply to the German reply to Mr. Wilson's questions based upon the German peace note will have been disposed of. Even so, it is in order for us to comment upon the document in question, and expose so far as we are able its specious character. It is for this purpose that we have related the parable of the pig.

Mr. Wilson laid down, as a prerequiste to consideration of any German advance, that the German army and navy abandon the barbarous practices in which they have indulged. The German plea on this point is to be read, not alone in the context of Dr. Solf's latest epistolary effort, but equally in every word and deed of the Teutons during the past week. Thus reconstructed, it amounts substantially to this:

"We have not been guilty of barbarities. The barbarities of which we have been guilty have all been committed under pressure of military necessity, and were hence unavoidable. As a special consideration, we agree now to desist from all barbarities, and conduct ourselves hereafter in legal fashion; but we cannot guarantee that we shall not from time to time suffer a more or less serious relapse. However, our work of the past four years has been thorough; we are confident that we have obliterated all the evidence; so we appoint herewith a commission of neutral residents of Brussels to investigate the charges against us, under the auspices of the gentleman who killed Edith Cavel."

In speaking of "neutral residents of Brussels" we have quoted accurately an official German despatch of October 22d. This is really delicious; it is one of the sublimest conceptions of the Teuton intellect, characterized as the letter is by a total absence of the sense of humor.

Of course the German reply is unsatisfactory. This statement can be justified upon a variety of grounds; but the one fundamental feature that stands out above all others is that it does not reply. We have delivered an ultimatum; Germany continues to discuss and argue and haggle. There is no place for discussion, for argument, for driving of bargains; we have named our terms, and we will have those terms, to the last word, or we will have nothing. Germany recognizes this, she recognizes the necessity of appearing to accept this ultimatum; but she accepts it with reservations and with evasions that make her acceptance worthless. The note can have no other intention than to deceive us. Germany has not learned her lesson, she has not learned that there is to be no "peace table" with German and Allied diplomats engaged in a protracted war of words to see what they can wheedle out of one another. And until Germany does learn that this war is to be ended by imposition and acceptance of terms, there will be no peace.

Germany's present state of mind is clearly shown by her press comments upon this latest note, which unanimously praise it as "paving the way for further discussion." When they shall have comprehended that we have nothing to discuss with them, they will have made a long stride toward the peace which they need so desperately. Until then, we can only let them prate about their honor, and the necessity of our granting them terms that will not make them feel badly about what they have done.

Some years ago, we read a swashbuckling romance of the Elizabethan era, all recollection of which has vanished from our mind, save for one incident. During the progress of a drinking bout, one worthy swashbuckler, of particularly disreputable sorts, vouched for the truth of a certain statement "upon my soul and the remnant of mine honor." He was greeted with hoots of derision, and the pointed query from one member of the company, "Hast any, Gaston?"

Hast any, Wilhelm?

A Carelessly-Guarded Gate

THERE is a growing conviction that the sudden invasion of the United States by that European epidemic known as Spanish Influenza, and the speed with which it has spread throughout the country, are due to the laxity with which the port authorities along the Atlantic seaboard have carried out their duties. This carelessness would have been inexcusable at any time; and it is doubly so just now, when the activities of the country should be organized for dealing promptly with every possible emergency.

If ever there was a period when the quarantine laws for guarding the ports of the United States against the entrance of disease should have been enforced with redoubled vigilance, it was during the summer and autumn of the present year, when it was known that a highly infectious and fatal disease was sweeping through Europe like a scourge of the middle ages.

In view of the imminence and deadly character of the disease, we had every reason to expect that the Federal authorities would set a double guard at our ports of entry, and instruct our quarantine officials to take every possible preventive measure against the landing, not merely of influenza patients, but of every passenger who had been exposed, during the ocean voyage, to infection.

Nor can any carelessness be excused on the ground that influenza has never been classed with the deadly diseases, such as yellow fever or the bubonic plague. While such an excuse might be valid for the layman, it cannot be allowed in the case of the expert professional men, whose duty it is to enforce the quarantine laws of the country. For they know full well that this was no ordinary epidemic of influenza or grip. The medical records of Europe were available; and the most cursory reading of the data that has appeared in the medical journals (to go no farther than that), should have revealed to these men that here was a disease, the exclusion of which from America called for the most exacting and rigid enforcement of the quarantine laws.

The obvious thing to have done, when the first ship with influenza patients on board cast anchor at a quarantine station, was to isolate that ship, with every soul on board, until the slightest possibility of carrying infection ashore had been removed. The rigid precautions that would be taken, if an arriving ship had yellow fever patients aboard, should surely have been taken in the case of this deadly scourge.

But what are the facts? Incredible as it may seem, influenza cases by the score and, for all we know, by the hundred, were taken ashore and placed in the general wards of the hospitals. Fellow passengers of the patients, who must inevitably have been exposed to infection, and must many of them have been carrying the disease, were allowed to go their several ways throughout the land.

Was ever official fatuity stretched to greater lengths than this!

When once the ship's company had scattered, whether to spread the infection among fellow patients in a general hospital, or among the unsuspecting and unwarned citizens, in home, office, passenger car, or theater, the mischief was done. But even when the plague burst forth in all its widespread malignity, both New York and the country at large seemed slow to awaken to the enormity of the peril. Only here and there did the authorities act with swift and effective measures, closing schools, theaters, and public meeting places, in the effort to prevent the further spread of the disease.

It is certainly a disconcerting fact that, at the very time when the country has organized itself, through the Red Cross and other famous organizations, to fight disease and prevent suffering, we should be smitten with a visitation which is causing more casualties and deaths in the homeland, than are occurring among our troops in the great world war.

Kultur

THE authors of this term, spelled with a capital K, have striven hard, by word and by deed, to impress its full significance upon the world. On the basis of their performances, we may feel justified in defining their Kultur as the addition of purpose and intent to Nature's program of evolution.

That program, as man has for a century or more visualized it, is a simple one. In the language of Darwin and his successors, it involves a constant struggle for existence, carried out through a persistent fitting to survive and resulting in actual survival of those who become best fitted. It is the fashion—it has been made the fashion by German writers—to speak with emphasis of the stern and uncompromising nature of this program. Nature's judgments are indeed inexorable, her program is to be sure cruel—but only as that program and those judgments apply to the species.

To Nature the individual is nothing, and her pressure upon him is indiscernible. He is not called upon to fit himself, he is not required to struggle consciously against anything. The course of evolution is imposed upon the species from without; the species lives and dies with the individual, but to the individual the program itself means nothing more than the inevitable succession of life and death.

Nature's program, as it applies to the individual, is ruthless perhaps; cruel, never. There is an absence of intent and directness that robs it of its sting in that quarter. But can we say as much of the deliberate effort of the German to impose a machine-made evolution of his own upon the race? Here is no absence of intent; the German consciously elects himself superman and consciously proceeds to the enforcement of that election. Here is no absence of directness; the program applies with the utmost explicitness and candor and cruelty of purpose to every individual with whom it comes in contact. The individual is called upon consciously to fit himself, consciously to struggle; both these efforts must take a direction, contrary to his every desire and instinct.

The German knows that this program is a cruel one, cruel to a degree making it wholly indefensible. The justification which it so sadly needs he seeks to give it by libeling Nature, by drawing a parallel that does not exist. The Pan-German principles will never stand justified on this basis, however, no matter how hard their exponents work. They must seek justification, if anywhere, in the merits of their case—they must abandon the attempt to make it stand on legs not its own.

What are the merits of the case? They lie, of course, in the intrinsic value of the intensive specialization which is the chief tool of the German machine-man. Is this good, of itself, or is it bad? We ask this question, not with reference necessarily to all specialization, but with reference to the particular variety that is here exhibited. And we must make this distinction, because the human race has gone too far in the direction of specialization to turn back. We have tried it, and found it good, in moderation. Shall we apply it to the limit, or shall we shrink from too much of a good thing?

If we are wise, we shall so shrink. We may even emulate the German, and draw a parallel from Nature—but this time a true one. The ant and the bee have always aroused the admiration of mankind on account of their industry, their complex civic organizations, their perfect adaptation to their respective environments. We see here the type of specialization which we are considering. It is the type of specialization calculated to impress upon us the fundamental identity between Nature's process of selection and the artificial process of selection involved in fitting certain individuals for certain ends, and for those ends alone. The ant and the bee have carried artificial selection to a point where it actually merges with natural selection, and the bodily structure, the form and physical equipment, of each individual is deliberatley modeled by the community in order that that individual shall be supremely fitted for a certain work. This is the outcome of the insect Kulturs. How does it compare with the human Kultur developed in Germany?

It compares surprisingly well. The specialized insect can do literally and absolutely nothing other than the thing for which he is specialized. The whole bee and ant community is unintelligent, stagnant. Aside from the merely mechanical business of getting food and reproducing, there can be no community of interest. We need not call by name some of the acts of the German Government during the present war to make clear the point that it has degenerated to a point where food and reproduction are likewise its chief, if not only, concern. Whatever originality the bee and the ant may have originally possessed, the perfect discipline and complete protection under which they have so long lived have reduced them, ages ago, to mere automata. Can we say anything better of the bulk of the German people, the ones especially whose experience does not take them back to a time when the present heartless machine was not in full operation? We do not think we can.

The conclusion seems then clear. However wasteful freedom and competition are, the congenital paronoiacs with whom we are at war must admit that they develop initiative and progressiveness in the individual and in the race. It is but begging the question to say that in a race developed according to the Germanic ideal such traits are not needed. Whether they are needed or not, they are wanted. We refuse to be machines; we insist that we shall be men. So, though it is the irony of fate that we must fight fire with fire, must adopt much of the objectionable technique of the enemy in order to beat him, let us not forget, when the emergency is past, that the measures adopted were for the emergency only. Let us then cease being machines, and take up again the noble pastime of being men.

Engineering

Steam Heated Spillway Gate.—An interesting detail of the new power plant on the Manistee River, just above Wellston, Michigan, is the installation of a steam-heating system in one of the spillway gates. The dam is formed with an enclosed chamber within which the gate opens and this chamber is provided with radiators which may be supplied with steam from the heating system of the power plant. In extremely cold winter weather, the steam is turned on so that the gate may be opened immediately in case of emergency. After the gate has been open for a few hours there is sufficient circulation of water to thaw out the ice on the other gates so that they also may be opened if necessary.

Preventing Cracks in Pavements.—At a recent meeting of the American Society for Municipal Improvements held at Buffalo, an interesting paper was read on frost-proof foundations for hard-surfaced pavements, in which it was suggested that the sub-grade should be laid with a course of hollow tile of say 4-inch height, overlaid with a foundation of 2 to 4 inches of concrete. On this, the paving material may be laid. The tile acts as a non-conductor of heat, preventing the frost from penetrating to the sub-grade and also acts as a drain for moisture. Should frost reach the sub-grade, the tile will break under the pressure and to insure its breaking, the tile may be scored at the bottom. The overlying concrete will bridge the breaks in the hollow tile. This will prevent upheavals of the pavement.

Economy of Electric Railway Operation.—According to the information recently published in the *Electric Railway Journal*, the Norfolk and Western Railway has shown large economies in the electrified mountain section of its system. For instance, in October of 1917, there was a saving of 26 per cent in the use of electricity in place of steam. During last winter, when severe weather interfered with the operation of steam roads, the electrified system was not interrupted and, as a consequence, 50 per cent more coal was shipped than could have been carried by steam power. The steam-drawn trains averaged 7 miles per hour and 3 to 4 miles an hour in the Elkhorn Tunnel, while the electric trains ran at a constant speed of 14 miles per hour. At the terminals only 45 minutes was required for the inspection of the electric locomotives as against 10 hours for the big steam locomotives.

Motor Street Cleaning.—In a recent issue of the *Engineering News Record*, the Street Commissioner of Buffalo, Mr. William F. Schwartz, tells of the advantages of motor driven street cleaning apparatus. In the fall of 1916 the city of Buffalo bought two motor sweepers to replace six horse-drawn sweepers and two sprinkling wagons. The motor equipment consisted of a combination sprinkler, sweeper and pick-up. During the year ending June 30th last, they cleaned 72,000 great squares (a great square consisting of 10,000 square feet). The cost per square was 2 cents lower than in the horse-swept districts. During the past year, two motor street-flushing equipments were installed each consisting of a 5-ton tractor and a 2,000-gallon tank trailer. Power is taken from the engine of the tractor to pump the requisite pressure for the flusher. The nozzles of the trailer are controlled from the driver's seat and the pressure at the nozzle is 35 pounds. In New York City the cost of flushing a great square with a two-man reel amounts to 56 cents, while with the motor equipment the cost is 20½ cents. Last winter the three tractors were equipped with snow-plows and saved the city at least $15,000 on snow removal work alone. The cost of ash and garbage removal was also cut about 25 per cent by the use of trailers and tractors.

Damage to Trees from Tarred Streets.—The injurious effects of tarred roads upon neighboring vegetation have been described in numerous articles emanating from both American and European sources. One of the latest investigations of this subject has been made at Milan by U. Brizi. The plants most susceptible to damage of this sort, says Signor Brizi, are species of horse chestnut (*Aesculus Hippocastanum* and *Aecarnea*), the leaves of which, at the beginning of summer, turn rusty at the edge and curl up slightly, while their surface is covered with numerous small spots, which, at first, are yellow and look as if covered with a thin layer of shining varnish. The leaf then curls up more and more, dries, and is easily blown away. Other plants very sensitive to the effects of tar are *Forsythia viridissima*, *Fagus sylvatica*, *Lagerstræmia indica*, *Magnolia grandiflora*, *Deutzia*, and *Cornus*. The damage is caused almost, entirely by the very fine dust raised by the passage of motor cars. This dust settles slowly and is most abundant on low plants and the lower branches of trees. Once deposited, the small particles of tar give off injurious vapors when strongly heated by the sun. Plant and parts of plants not directly reached by the sun never show this damage, while plants exposed to the sun are injured in proportion to the intensity and duration of sunshine. The best remedy is to keep down the dust by the regular and abundant watering of the roads.

Science

Cotton Gin Fires.—In Texas alone nearly 400 fires occurred in cotton gins last year, involving the loss of a million dollars' worth of cotton. A special investigation of such fires and methods of prevention has been undertaken by the U. S. Department of Agriculture.

Large Fumigating Houses.—In connection with the campaign against the pink boll worm on cotton, the Federal Horticultural Board is installing what is said to be the largest fumigating equipment in existence (surpassing even the cotton fumigating plants of Boston) at five towns on the Mexican border of Texas. The largest fumigating house at Laredo, will have a capacity of 15 freight cars. These cars will make possible the fumigation of the exterior and the interior of cars, as well as the contents.

Fish-Rescue Work on the Mississippi.—The Bureau of Fisheries reports that its work in rescuing fishes from the pools due to overflows of the Mississippi River before the drying up of the same was more successful during the past summer than ever before. In July alone the number of fishes salvaged and replanted was 7,709,700. There was an unusual number of carp and black bass. During the fiscal year ending June 30th, 1918, the number of food fishes rescued by these operations was 25,580,770. The expense ranged from 9 to 54 cents per thousand fish in the different fields.

An Aztec Food Plant Identified.—Mr. W. E. Safford, of the U. S. Bureau of Plant Industry, who has made so many interesting discoveries relating to the history of economic plants, has just published the first botanical description of a Chenopodium which was eaten as a vegetable by the ancient Aztecs under the name of uauhtzontli or huautzontli, and is highly esteemed by the modern Mexicans, who call it huauzontle or guausoncle. Botanists had hitherto identified this food of the Aztecs with the European Chenopodium bonus-Henricus L., to which it bears little resemblance. Mr. Safford received his specimens from the well-known archæologist and ethnologist Mrs. Zelia Nuttall, and he has named the new species in her honor C. Nuttalliæ. The plant is eaten when in bud and also when in seed.

Banishing the Barberry.—As the alternation of the grain rust, *Puccinia graminis*, between wheat and the common barberry is a very old story among botanists, it is curious that determined efforts to banish barberry from the wheat-growing regions of this country should not have antedated the present year. Last summer the Federal Horticultural Board invited the coöperation of more than 6,000 nurserymen throughout the United States in attempts to eradicate this plant. The nurserymen have quite generally signed pledges not to ship *Berberis vulgaris* to the Upper Mississippi Valley and a campaign is under way to exterminate the plant in the same region. It should be noted that the ornamental Japanese barberry (*B. thunbergii*) is not a factor in spreading rust and there is therefore no reason for its destruction.

Honey and Honey Plants.—According to an estimate of the U. S. Department of Agriculture, the honey crop of this country for 1918 will approximate 250,000,000 pounds. The *American Botanist* points out, in this connection, that as the nectar of flowers does not become honey until it is worked over and partly evaporated by the bees, these insects must move fully 150,000 tons of material during the season to make the honey crop, not including the honey consumed by the bees themselves. About half of this honey is produced from the nectar of white clover. Next in importance comes alfalfa, followed closely by sweet clover. These are all leguminous plants, as is logwood, which produces much honey in the tropics. Among the few plants yielding a honey that can be recognized are cotton, basswood, tulip tree, buckwheat, goldenrod and mountain sage.

The Failure of Hail-rods in France.—The vine-growing region of the Gironde, in France, has been quite extensively equipped in recent years with tall metal rods, similar to lightning-rods, known as paragrêles or "electric Niagaras," and alleged to afford protection from hailstorms. A careful study of the functioning of these rods during the six years 1912-1917 has recently been published by M. F. Courty, of the University of Bordeaux. The statistics presented show that numerous hailstorms have occurred in the vicinity of nearly all the rods. Moreover, according to M. Courty, there has been no obvious change in the character of these storms since the erection of the rods. His article is especially valuable because, while not pronouncing finally and positively against hail-rods, he points out some of the principal reasons for the errroneous conclusions that others have drawn in favor of them; for example, the fact that, normally, only one thunderstorm in five is attended by hail; that the area over which hail falls is normally very small in comparison with that covered by the thunderstorm, and hail tends to occur in scattered patches or narrow bands; and, lastly, that a district in which hail has fallen for two or three years in succession often remains free from hail for years, regardless of the installation of alleged hail-protecting devices.

Aeronautics

Bombing in Mid Air.—Among the many extraordinary incidents of the recent fighting, states *Flight*, was the feat of a British pilot who wrecked an enemy machine below him by dropping a bomb on it. The bomb is said to have hit the enemy fairly, and there was nothing left of the machine in the air.

Mudscraper for Airplanes.—Lieutenant Eytinge of the Candaian Air Forces has conceived of the most practical idea of having a mud scraper on the side of his machine. In this manner he is able to scrape the mud from his shoes before taking his place in the cockpit. The importance of this device cannot be overestimated, simple as it may seem. Many accidents are due to a little mud becoming wedged in the control members of a flying machine.

The Liberty Motor in Action.—According to reports from the front, it appears that the Liberty motor is proving quite successful under the grueling conditions of aerial combat. A large number of these motors are in use in DeHavilland-Four two-seater machines which are employed by the American forces for general reconnaissance, photographic work, daylight bombing, and even combat purposes. Our DeHavillands are proving excellent general utility machines, and are averaging better than 110 miles an hour, which is not at all bad for a two-seater. The Liberty motors are functioning as well as might be expected of any motor that is still so new in design; and with the steady improvements being made as the result of actual operation at the front, the Liberty design will no doubt be practically perfect in six months' or a year's time. Still, it remains a fact that the Liberty engine is a vast success today, inasmuch as it is the first aeronatuical engine to be produced in such vast quantities and by standardized methods.

A New British Airplane.—According to *Aviation*, English newspapers are giving prominence to a report of a new type of British airplane, which, having been tested at the front with the greatest success, is about to be employed there in large numbers. No technical details are given, but it is said that the new machine has enormous speed and climbing power. It is capable of carrying great weight in bombs, machine guns, and other equipment, and of attaining a height of 20,000 feet in an astonishingly short time. It is said that the machine can cover long distances at a speed which leaves all but the fastest modern scouting machines far behind, and thus is able to cross the enemy's lines and drop bombs and return for a fresh load within a time limit far less than any of the earlier airplanes. The engines of the airplane are declared to be so completely reliable that risk of compulsory landing in enemy territory is virtually eliminated. It is added that no one of these wonder machines has yet been downed, notwithstanding the utmost efforts of the Germans.

The Value of Aerial Photography.—Much of the success of the British offensive begun last August 8th was undoubtedly due to the accurate information of the enemy dispositions supplied by the many excellent photographs secured by British airmen. Nearly four times as many photographs were taken in one week as during the preceding seven days, notwithstanding the greatly increased resistance of the enemy. Although little is heard of the R. A. F. Photographic Section in the official communiques, and of the amazing celerity of its operations, it is universally regarded as a model of its kind. It is no uncommon performance in the Royal Air Force for a dozen or more finished enlargements of a new enemy position to be in the hands of the Intelligence Staff within 45 minutes of the plate being exposed in the air. That the Germans themselves are conscious of British superiority in this respect is shown by a recently captured German order, in which special attention is drawn to the various ways in which enemy secrets are continually being disclosed by British cameras, and giving strict injunctions to guard against this.

How Germany Stands in the Air.—At present, according to data published in Paris, the utmost strength of the German Air Forces on the Western front numbers between 2,600 and 2,700 machines. These consist of 200 bombarding machines, 250 for maintaining liaison with the infantry, 1,100 fighting machines, and 1,100 for reconnaissance work and regulating artillery fire. German losses, according to figures established by French authorities, involve the renewal of about three-quarters of the total strength every month, as Allied aviators and anti-aircraft guns bring down on an average about 900 enemy planes monthly. About the same number of airplanes, according to the admission of the Germans themselves, are lost every month from other causes, such as accidents in landing, destruction in airdromes, and ordinary wear and tear. This means that the enemy must replace his losses with 1,800 new machines a month, or 60 every day. These figures explain eloquently the pleadings of the German commanders in various orders that "all missions which are not of first importance from the fighting point of view should be abandoned." Allied supremacy in the air is already a most indisputable factor in the situation.

Artillery Which Keeps Pace With the Infantry

How the Western Front Was Taken Out of the Trenches and Into the Open

THE most remarkable one hundred days in all history are the past one hundred days. For, in that brief period, we have witnessed a succession of passing events which in the aggregate have changed entirely the outlook of the great war.

One hundred days or so ago, the Germans were launching their formidable "peace drive" along the Marne and about Rheims. Already they spoke as conquerors. And why not? Had they not succeeded in breaching the Allied intrenched lines and overrunning wide areas of France not touched by the war since the open warfare of 1914?

Typical barbed-wire entanglements which are readily shattered by the tanks

Then came the Allied counterstroke on July 18th, at the height of the German "peace offensive." The Germans crumbled in the Marne salient of their own making. They broke. They fled. They left thousands of guns and supplies and over one hundred thousand prisoners. The German army lost the initiative. Foch, the Allied generalissimo, seized it; and in a series of blows struck up and down the line by British, Belgian, French and American troops, the Germans have been driven back between Pont-à-Mousson and Nieuport an average distance of 28 miles. Their great bulwark in France, the vaunted Hindenburg line, has been shattered. From proud and irrefragable conquerors they have been transformed into whipped but desperate foes, asking for an armistice so as better to disguise the seriousness of their recent reversals.

What has brought about this great change? The first guess might be numerical superiority, but as a matter of fact this superiority was not with the Allies when they counter-attacked last July. The American troops then ready for the battle were not in great enough numbers to give Marshal Foch a marked advantage. Strategy? Yes, in great measure. But under the methods of fighting existing at that time, strategy alone would not have given us the victory on the Marne, which proved the means of regaining and retaining the initiative. Lastly, we come to tactics, and in that guess there probably lies the solution of the great Allied offensive of one hundred days' duration and still without sign of coming to a close.

Why Previous Offensives Automatically Came to a Halt

For nearly four years, or until March 21st last, the Germans and the Allies faced each other along intrenched lines between the North Sea and the Swiss border. Occasionally one side or the other undertook an offensive which gained a few hundred yards of territory at a heavy cost in lives and treasure. Indeed, so slow was the progress by either side that the more pessimistic among us were wont to take for granted the invulnerability of the trench lines. At a tremendous cost the British and French, during the collective battle of the Somme, literally blasted their way through the serried defenses of the enemy, only to reach his Hindenburg line with its formidable concrete defenses and concrete communication tunnels and broad belts of barbed wire. Confronted by these new defenses, the Allies might well have become discouraged.

But all the while, particularly in France, the subject of mastering the trench-attack problem was given constant attention. The reason why most offensives came to a halt after a brilliant start was obvious. The attackers, moving behind the barrage fire of their artillery, were generally able to advance with little difficulty across the upheaved fields and shattered earthworks. Once the limit of the supporting artillery was reached, however, the infantry either had to stop and organize the ground just won, or push on without supporting artillery in the face of untouched machine-gun nests and trench elements. Artillery and supplies could not be brought over the shell-pocked terrain until roads and railroads were built, and that required several days. Meanwhile the enemy, recovered from the first onslaught after giving up some ground, was generally ready to come back with a counter-attack delivered by fresh reserves and supported by his artillery near at hand.

One form of Stokes mortar employed by the British

Until the battle of the Somme the Allied offensives were generally successful at the opening, but the gains were soon pared down somewhat by determined German counter-attacks. By the summer of 1916, however, the Allies learned not to go beyond the extreme range of their supporting artillery; and by rigidly limiting the objectives of an offensive, the German counter-attacks were readily repulsed by the infantrymen on the new ground, backed by an artillery barrage. This practice, obviously, limited the ground gained by each offensive; but for want of a better method of attack the Allies preferred to advance a mile or less at a time, rather than many miles in the face of unreduced machine-gun nests, only to be thrown back with still heavier losses by subsequent German counter-attacks.

The French Solution: The "Canon d'Accompagnement"

It soon became perfectly obvious to the French and others that the great need in trench warfare was artillery to accompany the infantry over any kind of terrain, so that the attackers could either keep on going under favorable conditions or intrench under the support of their own accompanying artillery. To this end the French developed the 37-millimeter (1½-inch) quick firer, mounted either on wheels or on a simple, lightweight tripod. This cannon appeared to be ideal for the purpose. The present model weighs about 240 pounds complete, and fires its one-pound shell at the rate of twelve to eighteen per minute.

The British, on the other hand, introduced in 1916 a portable piece in the form of a mortar known as the Stokes mortar. This weapon is no doubt the lightest of all accompanying artillery, weighing about 105 pounds for the lightest and about double that for the heaviest, complete and ready for work. The bombs for this mortar range from six to fifteen pounds.

In actual practice, however, the accompanying artillery of the British and the French did not prove a tremendous success, not because of any inherent flaw in the designs, but merely because of the difficulties of ammunition supply. Firing anywhere from eight to twenty times per minute, the cannon or mortar during ten minutes' action would require the services of from sixteen to forty men to carry shell, or say 20 ammunition carriers for 100 rounds. It is in this respect, then, that the accompanying artillery failed on the field of battle, although in isolated instances both the 37-mm. cannon and the Stokes mortar have done excellent work in reducing stubborn machine-gun nests. These same weapons are still in use today, although their limitations are thoroughly appreciated.

When the Germans planned their great offen-

Latest types of accompanying artillery used by the Allies and the Germans

At the left: Captured German "minenwerfer" employed by them during the March offensive. *At the right:* Another form of German "minenwerfer" with its small caisson, arranged to be man-drawn. *In the oval:* The last word in accompanying artillery—the French Renault tank provided with a one-pounder cannon

sive of March 21st, they did not overlook the importance of accompanying artillery. Like the Allies, they had come to realize the reasons for the automatic stoppage of most offensives in trench warfare; and it was their aim not only to breach the Allied trenches but to exploit the breach like so much water pouring through a dam it has burst.

For their purpose the Germans used their favorite weapon, the *minenwerfer* or trench mortar, mounted on wheels and drawn by men or by horses. Ordinarily, this German trench mortar is mounted on a heavy iron base and is arranged only for high-angle fire. So in order to permit of horizontal fire—the Germans appreciated the necessity of horizontal fire when open warfare was engaged in after the break through—the *minenwerfer* was provided with a special trail for bringing the iron platform to a 45-degree angle, and thereby the barrel to a nearly horizontal position. Alone, the mortar weighs 330 pounds; with the special trail, 240 pounds more, or a total of close on to 600 pounds. The projectiles weigh about ten pounds.

The Germans made a serious blunder in designing their accompanying artillery. Their special *minenwerfer* was much too heavy to keep up with the infantry; indeed, it is said by many Allied soldiers that only on rare occasions did they see a *minenwerfer* in operation during the great German offensives, and then only when the lines had become more or less stabilized. The Germans themselves, in certain captured documents, admitted the failure of their makeshift accompanying artillery, and in later offensives urged the regular field artillery, or 77 mm. cannon, to keep up with the infantry as far as possible.

How the Tanks Proved the Only Successful Solution

Because of the impossibility of maintaining ammunition supplies for the accompanying artillery, certain French authorities recommended the use of some form of vehicle which would carry gun and crew and ammunition. The armored automobile was considered in this connection, but because of the rough ground to be traversed it was as soon forgotten. Finally, the farm tractor with caterpillar tread was considered, and soon work started on a new form of accompanying artillery.

Meanwhile the British had come to the same conclusion, quite independently; if anything, the British had begun work along this line some time before the French. At any rate, the British introduced the mobile artillery popularly known as the tank during September, 1916. As for the exploits and early successes of the British tanks, these are too familiar to require mentioning. The first French tanks appeared in April and May, 1917, and immediately proved the practicability of the tank idea.

Just as there had been heavy losses in infantry attacks during 1915 and 1916, so there were heavy tank losses in 1916 and 1917. Careful study disclosed the fact that tanks, even if armored against ordinary machine-gun and rifle fire, are not altogether immune to shell fire and other defensive measures of the enemy. Essentially, the tank is a weapon of surprise and must only be employed as such. What is more, tank safety rests in numbers; the more tanks engaged the greater the security of each tank. Tanks alone cannot achieve a victory. The infantry must accompany the tanks, just as the infantry must take over the ground which its own artillery has pounded to dust. Once more, success rests on perfect teamwork.

The earlier tanks of the British and French were large and slow-moving vehicles, and considerable difficulty developed in coördinating their work with the infantry. It often happened that infantry got ahead of the tanks, or that the tanks got ahead of the infantry, in either event causing a serious slip in the offensive which the enemy made the most of. And when a large tank, presenting a fair mark, was destroyed by hostile shellfire, it resulted in a serious loss, since it carried anywhere from six to ten men as crew.

So it came about that instead of increasing in size as had been predicted, the land battleship or tank simply developed the other way and toward speed. Early this year the British introduced their "Whippets" while the French introduced their "Renaults," both types being small, two-man tanks, equipped with a single machine gun or one-pounder cannon mounted in a turret

Captain Schroeder and his flying togs in which he won the world's altitude record

so as to be available for a traverse of 360 degrees. These tanks, making between eight and twelve miles an hour, have proved more or less immune to German shellfire because of their smallness and rapidity of movement, especially when maneuvering through tall grass as they have been doing of late.

To the fast, two-man tanks, the Allies owe much of their present success. In the first place these tanks enabled General Mangin on July 18th last, to fall on the exposed flank of the Germans in the Marne salient, with only a few minutes' bombardment. The Germans

Submarine chaser taken in tow in the Bay of Biscay

received no prolonged artillery warning at all, as was customary in most offensives of the Allies until then, with the single exception of that of General Byng, whose British army scored a great victory facing Cambrai during November of 1917. General Byng was the first to use tanks instead of artillery preparation, and deserves credit as the originator of the present Allied surprise tactics by means of tank fleets.

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A Five-and-a-Half Mile Climb in an American Airplane

IT seems reasonable to suppose that the recent world's altitude record of 28,900 feet established by Capt. R. W. Schroeder, U. S. A., at Dayton, Ohio, will stand for many months to come. And so the record stands today as the achievement of an American aviator, carried by an American-built airplane, and propelled by an American-built engine.

For his record climb Captain Schroeder used a single-seater Bristol fighting plane, equipped with a 300-horse-power Hispano-Suiza engine. Caleb Bragg's previous American altitude record of 20,250 feet, made with a Wright-Martin model airplane equipped with a Hispano-Suiza engine, had stood for a year and was only eight feet under the world's record of the International Aeronautic Federation made by Lagagneux on December 13th, 1913. The Government has accepted Captain Schroder's record as official, thereby regaining our laurels lost when Lincoln Beachey's world record of 11,642 feet made at Chicago in 1911, was subsequently beaten.

Captain Schroeder's experience is interesting. While it was a comparatively warm day on the ground, several of his fingers were frozen and in removing his goggles for an instant for adjustment, his nose was also frost bitten. The intrepid aviator used a rubber hose direct from the oxygen bottle, regulating the supply by means of a valve on the bottle. The hose was placed in his mouth so that he could breathe air and oxygen at the same time. At intervals he pressed his tongue against the end of the hose in order to tell if the oxygen was still flowing. This method was quite satisfactory, except that the oxygen bottle and the rubber tube gathered about a quarter of an inch of frost, which made it very unpleasant. Captain Schroeder found the oxygen supply indispensable above 25,000 feet, receiving warning of this fact by a sort of drowsiness and mental depression, which were removed with the taking of oxygen. At the 29,000-foot level the temperature was recorded as 62 degrees below zero, Centigrade.

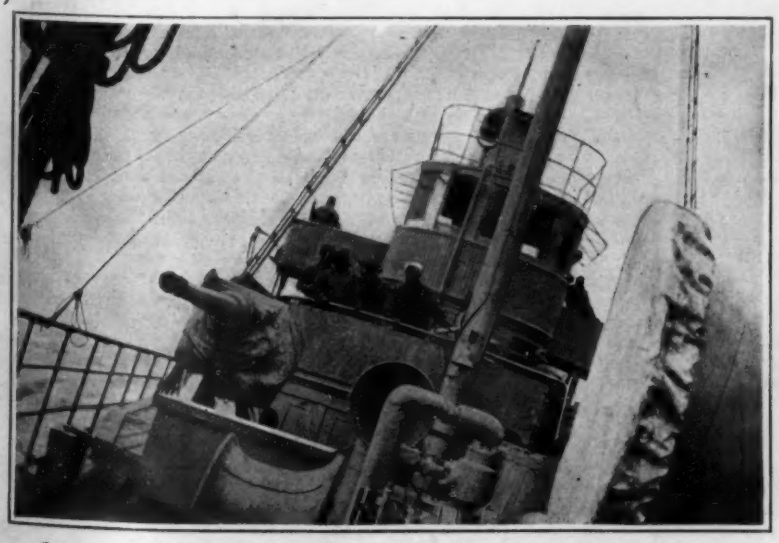
The Hispano-Suiza engine functioned perfectly throughout the ascension, and only stopped when the gasoline supply was exhausted. Captain Schroeder then volplaned down from his great height and landed at Canton, Ohio, over 200 miles from the starting point.

U-Boat Chasers Crossing the Atlantic

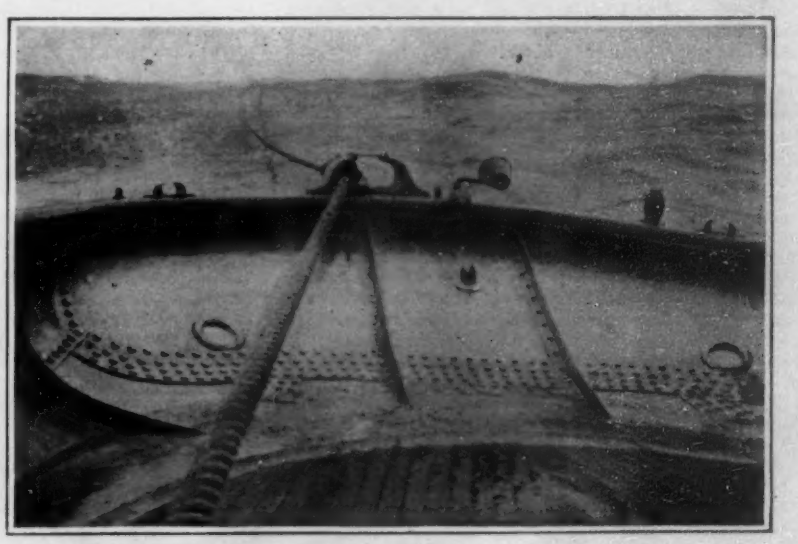
A WOODEN motor boat, 110 feet in length, is a small craft to make the Atlantic crossing. It is true, motor boats much smaller than this have crossed under their own power, and in more than one case, the venturesome trip has been made by non-professional sailors. As is well known, we have built several hundreds of these submarine chasers, and they are doing good work on both sides of the Atlantic. With their fine, high bows, rather graceful sheer, and single mast amidships, they are a familiar sight to residents on our Atlantic seaboard, where they have been doing regular patrol duty.

A large number of these craft, also, have been for many months engaged in patroling the seas off the coasts of Great Britain and France, particularly in locations which are known to be the favorite haunts of the U-boat. When they are engaged in offensive work, they go out in groups of several, and by observation and by their listening devices, they try to get in touch with the underwater pirate. As soon as he has been found, the group of chasers follows a course of maneuvers which is designed to make it impossible for the enemy to get out of touch; and the area below which he is operating is heavily attacked with depth charges.

Many of the chasers were taken over by French crews and are now in service under the French navy off the French coast. A large number of them were taken across by American crews which were composed largely, and in some cases exclusively, of men of the Naval Reserve. When the vessels were towed across, the towing ships were frequently converted yachts, of the kind shown in one of the accompanying illustrations. As will be noted, the passage was frequently made in heavy weather, with the seas running so high, that at times the little chasers were invisible from the deck of the towing yacht.



The towing ship (a converted yacht) in heavy weather



A following sea between towing ship and chaser

Earth Roads and Air Roads

What the Commercial Airplane Will Mean in the Development of Our Railways

By Charles Henry Davies, C.E.

TO the time of MacAdam, roads were little more than tracks in the dirt. Such questions as weight pulled, amount which could be carried at one load, and speed of transportation, were considered, if at all, as regulated by the Providence which supplied the horse or bullock, not as factors which might be regulated by man. The Roman Appian Way, first and for centuries one of the few stone roads, was looked upon as too much a world wonder, too much an example of unbridled expenditure, for practical imitation.

But with the railroad came the beginning of that revolution in road-building which is still going on. It was soon discovered that the steam horse, with all its power to aid the spread of civiliztiaon, reduce the cost of living and like a magic rubber band draw communities closer together, was of restricted use unless man, beast and goods could get to and go from the railroad.

This is mentioned here as an accepted fact, an actual accomplishment. Unfortunately, in thousands of communities it is as yet but academically so. We still pay more to haul a ton of wheat from many a farm to the railroad than to transport it from depot to milling point —even, in some cases, more than to ship it across the ocean after it is milled. Far too many of our feeder roads are still too much akin to the earth trails of our forefathers to be distinguished, save by name alone, from those early beginnings of roads.

Yet much has been accomplished, and the hard road is coming more and more into economic consideration as an essential part of land and water transportation. The bicycle began the agitation; the automobile stirred it to the boiling point; the trolley line between centers made the need more evident; finally the railroad man who understands that where the roads are good he profits by more freight has begun carefully to foster the idea.

Where water transportation of produce is possible, the boat lines have found their heaviest traffic when roads are improved. Already the Post Office is bringing the motor truck to bear upon the parcel post problem, and in many places is building up a shipping industry of such materials as eggs, fowls, butter, cheese, milk, berries, fruits, garden truck—a traffic which otherwise, lacking good transportation, would not exist.

Now comes the airplane as the newest transportation factor; and perhaps more than any of the rest, it is one that will have a vital bearing upon the matter of road construction.

The casual reader will likely see little connection between the matter of aerial travel and that of roads. In spite of the advertising which aviation has been given continually in the daily press, there is as yet little real popular appreciation of the principles underlying aerial work.

It is as yet mostly the spectacular, the heroic, the stupendous, which interests the public. But not only is the connection there, it is a very important one.

Of future developments in power and in plane construction it is not wise to speculate. But at the present time, the limiting factor in aerial transportation is the landing and the starting field. All our aerial maneuvers, be they military or civil, sporting or practical, must start from the ground, and all our planes must get into the air by an accelerating run over the ground. No plane in the air can land safely save when there is enough smooth space to permit a lengthy run on wheels after the mechanism has settled to *terra firma*. Those startings and landings are most easily effected which are made dead against the wind. As the wind blows where it listeth, not where the aviator would have it, that flying field is the best which is not only large, but square, rather than long and narrow.

As yet, of course, commercial aviation is nothing at all. The war has given such an impetus to military aviation that we accept this fact without much thought. But hardly will there be a gathering about a peace table, when we shall find the air, if not filled with planes, at least filled with plans by which planes can render commercial service. Already mail is being carried between three cities; extension of the service waits only long enough for it to be demonstrated sufficiently successful to warrant extension. Yet with everything in its favor in New York, Philadelphia, and Washington, it took some hunting and some deciding to fix on the best landing and starting places; and even so, the Washington field, at least, is of that long and narrow pattern which makes a take-off in a high east or west wind a matter of concern to the aviator.

Consider what it will mean for the smaller city to be brought intimately into touch with its near neighbors by swift mail. It is the history of the Post Office Department that every extension of its facilities has been followed by a rapid increase in wealth, in commerce, in population, in raising the standard of living.

Rural Free Delivery has completely changed the status of the farm from an isolated political and economic unit to that of a closely knit part of the whole fabric of the country. Parcel Post has done more in the same direction for the sections that do not enjoy the advantage of closeness to a large commercial center than any other single factor since the spread of the interurban trolley. Motorized parcel post is now working a still further revolution, and it is just beginning.

Whether this particular Washington-New York mail service succeeds or finally fails is beside the question. Aerial mail service is coming and coming fast. The next twenty years will see it so common that people no more will raise their heads at the hum of the postplane. Passenger service is next and finally parcel post or some modification thereof. But none of these things are possible, in the light of our present methods of aviation, without landing fields, and plenty of them. And landing fields are not available without good roads, and plenty of them.

It costs a good deal more to take the average rolling country and make a landing field out of it than it does to build a hard road from some more distant but more level stretch of land to the locality affected. Fairly good hard roads can be built for $5,000 per mile; a good one for twice that. It would be but a drop in the bucket to spend $25,000 making the right kind of a landing field out of rolling country. And while in the far future no community will be satisfied which has not its landing field in the immediate vicinity of its commercial center, just as today it is not satisfied without an adequate railroad station in that location, it is not the far distant but the immediate future with which we are concerned.

An early argument against railroad extension was that it could not get to enough farms and enough towns to make it pay. Today we have the trolley, the automobile, the bicycle, the road, the boat, the stage, as feeders for the railroad. No one expects the freight train to stop at every farm, or the mail train to do more than carry sacks between the centers. It is just as idle to argue that aerial mail, passenger or express service will not be a success because it can't land everywhere, as it was to make the corresponding claim against the railroad. The plane will need to be fed with its passengers, its express, its mail, its produce, exactly as are the railroads. And how can it be fed except by the roads?

Another argument once urged against railroads—indeed, still advanced by some timid souls—is the possibility of accident. The same argument is employed against the airplane as a commercial factor—"it isn't safe."

Neither it is—yet. But it is a great deal safer than the general public realizes, and will be even more so by the time this war is over. Every plane that is built, every plane that is wrecked, teaches its little lesson of how to do better next time. To be sure, as long as we depend on a single gasoline engine for power, so long will planes sometimes have to come down when they don't want to. Now flying at a great height—the higher the safer—the pilot has plenty of time to pick his landing spot. But until this country has been checkerboarded with landing fields not more than twelve miles apart—or sixteen at the outside—the aviator will always have to come down in the best open space available at the time.

If that open space is not adjacent to a good road, how will the pilot transfer his passengers, his freight, his mail, to the motor car summoned by telephone or wireless? More important still, what will happen to plane and contents when the "best open space" doesn't exist? A plane forced to descend in a forest is wrecked. One forced to land in water will in all probability drown its human complement. One which must come down on rocks will probably smash itself, if not its human content. But it takes no abnormal skill to land safely on a good road, if only the trees on either side are cut away to a sufficient distance to let the wing spread through.

The good road, then, will not only bring the landing field sufficiently close to the commercial center to make it a link in the aerial service; it will, in addition, provide that emergency stopping point, which simply must exist if a continual round of tragedies is not to dot our progress toward that ideal, the plane that never fails. There is thus the most intimate relation between the hard road and the trackless one through the air. It is but demonstrating anew that transportation is one problem, not many; that its various ramifications must be considered with reference each to each, not to each alone.

Those who have the cause of aeronautics at heart must of necessity be good-road boosters; those whose lives are bound up with the idea of roads, more roads, good roads, should not omit from consideration the very evident fact that the aerial age, on the threshold of which we stand today, will present them with their most powerful impetus, their most potent arguments. The airplane must no more be hindered from doing its best work through failure of the road system properly to feed it than has the railroad been so handicapped. The argument that the airplane cannot give good service because of the deficiencies of our roads must be thrown out of court—turned back on itself as a compelling reason for changing the roads, rather than one for neglecting the air.

It is unthinkable that a government which will provide motorized parcel post, rural free delivery, aerial mail service, subsidized railroads, all for the transportation of intelligence, will not in the future go further in its aid of roads and road-building than it has gone in the past. But it will only move in this direction if we—the people, who are the government—make evident our demand that the newest method of transportation be not handicapped by a failure carefully to consider and adequately to foster the improvement of that oldest means of getting man and his works from place to place—the common road.

Baedeker as an Office of Military Intelligence

IN the work of preparation for the war which was to Germanize the world there is at least one German family who can say that they did their job so thoroughly and efficiently that nobody could find fault. That family is the Baedeker family—the authors of the famous guide books. Whether they were perfectly well aware that they were part and parcel of the great conspiracy or whether they were merely the innocent tools of their rulers, is a question on which positive evidence may be forthcoming one day. As they are a Saxon family and are said to have none of the unpleasant characteristics of the Prussian, it is but charitable to assume that they had no other intention in the compiling of their guide books than to provide material for the edification of the harmless tourist. Nevertheless, they succeeded in collecting between the innocent looking covers of their guide books unrivalled information about every country in the world which must have been of priceless value to the German General Staff in their war of conquest and spoliation. Also in the process of compiling these works they must have obtained all manner of other information which it was considered advisable not to print, but which, quite innocently, of course, found its way into the secret archives of the Wilhelmstrasse.

It has been said that if England is a land of invention Germany is a land of imitation. Even in the matter of guide books Germany cannot claim originality. It was Karl Baedeker who some eighty-four years ago spied the English Murray hand books for travellers and considered how he could imitate and improve upon them, and so satisfy the artless curiosity of his fellow countrymen during their travels abroad.

The Baedeker family have been devoted to books and book-selling for nearly three hundred years, but this was by far their biggest undertaking. Old Karl had himself been an energetic traveller through Western Europe and he had already published and improved Klein's guide to the Rhine. The next volumes in the series: Belgium and Holland, Germany, Austria and Switzerland, were issued from Coblenz, and it was not till later that the firm removed to its present enormous headquarters at Leipzig. Old Karl died in 1859, and he left three sons to carry on the work and the series of guides had almost crowded out the rest of their publishing business by the time the war broke out.

The head of the firm was then the youngest of these sons, Fritz Baedeker. Where he is now, it is not known. He may be in the army or he may be in that vast army of the dead which has been offered up to sacrifice to the German War God. But we may fancy that his services were too valuable to permit of his being sent to the trenches. Possibly he is engaged in preparing guide books of the new German territories, which it is fondly hoped the German tourist of the future will be able to gloat over.

Maybe he is still waiting for the famous Peace which will enable him to publish new editions of the guide books, which are no doubt already prepared, of Germany's vast new Colonial possessions, which at present together with her old colonies are in the safe custody of the Allies.

When the war began, another generation of Baedekers had already been trained with a view to their improving the efficiency of the guide books. His sons with commendable zeal set themselves to master the European languages and the systems of government prevailing in the different countries. Young Hans studied archaeology in Rome and Alpine lore in Switzerland; and young Ernst joined him in absorbing the details of London, Edinburgh, and other leading capitals.

The Baedekers were astute enough to get the native authorities in each country to assist them in amassing the facts they wanted. Thus distinguished English scholars edited the English editions and a famous English publisher undertook the publishing and the distribution of the English series over every land and continent outside Europe, excepting the United States.

In those days of peace the scholars of every nation were only too glad to help an enterprise built up in a country that so often professed to have the cause of peace so dearly at heart.

Altogether there were upwards of seventy of these guide books which covered every part of the globe save Poland.

There was one on Palestine and Syria including the principal routes through Mesopotamia and Babylonia and the island of Cyprus. There were 21 maps, 56 plans, and a panorama of Jerusalem—an extremely useful guide to the British forces now in occupation there.

The book on Belgium and Holland is a wonderful survey of every inch of these countries. The Belgian coast must have been gone over hundreds of times and every creek and gully explored. Not a detail was overlooked that could have been regarded as of military importance.

(Continued on page 363)

With Scalpel and Drug

Work of the General Medical Board of the Council of National Defense

By C. H. Claudy

THERE are few to dispute the statement that United States soldiers and sailors are the best cared-for armed forces in the world. Better fed, better housed, better paid, better trained and better clothed than the fighting forces of any other nation, it is no wonder the American fighting man is surprising his comrades with the *élan* of his attack, the bulldog tenacity of his grip, the resource and the initiative of his plans.

But he is not only better provided for in every material and mental manner than his brothers in arms—he is better served when ill, better operated upon when injured, better nursed when in hospital. Spite of the fact that for years the great surgical centers were in Vienna and Berlin, the United States has so forged ahead in medicine, in sanitation, in hygiene, in inventive appliance and constructive operative practice, that today there is no body of army surgeons, army doctors, or army hospital corps which can be placed ahead of American doctors.

How much this is due to native Americanism, and how much to the plans and the labors of the General Medical Board of the Council of National Defense, working in close coöperation with the Surgeons-General of the Army, Navy and Public Health Service, it is not necessary to discuss. Suffice it that the General Medical Board is the medium through which a revolution has been worked in the application of medical and surgical knowledge to army and navy problems.

Very briefly, the General Medical Board came into existence as follows:

The Council of National Defense is composed of six members of the President's Cabinet—the Secretaries of War, Navy, Interior, Agriculture, Commerce, and Labor. The council nominated and the President appointed an advisory commission of seven specially qualified persons, each having knowledge of one great field. The chairman of the committee on medicine and sanitation of the Commission was authorized by the council to organize the General Medical Board for the purpose of aiding in the enormous expansion of the various Government bureaus and coördinating with their work the resources and talent of the civilian medical profession. This board thus represents the civilian population in its relation to the four Government administrative offices of the Surgeons-General of the Army, Navy, and Public Health Service, and the Red Cross.

It is not necessary here to refer to the labors of the committee on medicine and sanitation by which the armed forces of the United States secured the services of so many civilian physicians. There were 1,800 enrollments in the Medical Reserve Corps at the beginning of the war. Now there are more than 21,000, of whom 18,228 are on active duty.

A more recent development is the creation and development of the Volunteer Medical Service Corps of the United States. For many reasons many otherwise perfectly qualified physicians, surgeons, laboratory workers of all kinds, hospital experts, etc., are unable to serve the country in the M. R. C. Yet a man who cannot well be an asset for overseas duty may render most efficient aid here. It is to secure the services of such men that the V. M. S. C. is organized; its object is to establish an emergency medical organization to perform, when required, such civic and military duties as are not provided for.

The services of members will be called for and rendered in response to requests to a Central Governing Board from the Surgeon General of the Army, the Surgeon General of the Navy, the Surgeon General of the Public Health Service, or the General Medical Board of the Council of National Defense. The president, vice-president, and secretary of the Corps constitute the executive committee of the Central Governing Board and direct the activities of the Corps.

Only such physicians are eligible for membership as would be accepted in the Medical Reserve Corps were it not for physical disability, age beyond 55, essential public need, essential institutional need, or dependents. Women physicians are eligible. Members of the Corps are authorized and encouraged to wear the insignia of the Corps.

The services of the members of the corps will be rendered to existing governmental agencies, upon the request of the Army, Navy, Public Health Service or Red Cross, to fill certain needs not already covered, and such other services as may be determined by the Central Governing Board of the Corps. So far there have been over eight thousand applications for enrollment in this corps, constituting a most valuable military adjunct, since every enrollment accepted and every member assigned to work here can release a man qualified for overseas duty.

Creation and mobilization of this corps is perhaps the most spectacular feat of the General Medical Board in recent months; but it were a brave man indeed who would say it was the most vital. In selecting a few from the many committees and sub-committees of the General Medical Board for mention here, no invidious comparison of the value of work done by those not mentioned is intended. The entire issue of this publication would not be large enough even to summarize the labors of the various committees on child welfare, civilian coöperation in combatting venereal diseases, dentistry, editorial, hospitals, hygiene and sanitation, industrial medicine and surgery, legislation, medical advisory boards, medical schools, nursing, research, states activities, surgery, volunteer medical service corps, and women physicians and their numerous sub-committees.

But while all are perhaps equally interesting and equally important from the medical standpoint, some of them command more attention than others from the popular standpoint. For instance, the mobilization of women physicians has been accomplished, in this country for this war, as never before in the world's history. The woman physician has fought a good fight and won a great place in medical annals, but never before has she been considered the war factor that she now finds herself.

The Committee of Women Physicians has made a comprehensive survey of the 5,989 women doctors of the country. Of these 5,788 are in active practice. The committee has registered 1,916, or 33.1 per cent. who offer their services to the Government. Of these, 803 are listed under the following specialties: Administration, 58; anesthetics, 180; bacteriology, 24; chiropody, 1; dermatology, 1; dietetics, 5; electrotherapy, 11; eye, ear, nose and throat, 34; gastroenterology, 1; hydrotherapy, 2; hygiene, 13; interpreters, 18; kinesiatrics (medical gymnastics), 3; lectures, 9; neurology, 36; obstetrics, 146; orthopedics, 13; pathology, 18; pediatrics, 121; physical examinations, 2; psychiatry, 59; public health, 12; radiography 21; reconstruction, 1; research, 6; sanitation, 36; surgery, 196; tuberculosis, 14; venereal, 3. The 1,113 others stated that their services are available for substitute work in hospitals or private practice, service under the Red Cross, in industrial plants, and for part-time service in their home communities.

The committee keeps in touch with the graduating

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Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

Potsdam and Shotguns

To the Editor of the SCIENTIFIC AMERICAN:

It is said that Potsdam is complaining about the use of shotguns by the Yankees and pretending that it is a violation of a certain rule of the Hague Convention forbidding the use of weapons or practices which cause unnecessary suffering. In view of a number of practices (use of fire, gas, etc.), initiated by the Hun in this struggle, such complaint emanating from Germany is ponderous evidence as to what a funny old world this is, and what it really can afford.

As said shotguns are doubtless the standard 12 gauge loaded with buckshot charges, it seems the meticulous Potsdammers will have to go some to make out a case on that. The number of pellets in the factory loads varies with the size, but the favored ones contain 9 or 12 near the size of the ball used by the old-fashioned muzzle-loading squirrel rifle, or about one-third the weight of the modern army rifle or machine gun bullet. As these shot begin to scatter immediately upon leaving the muzzle and the dispersion is considerable at a moderate distance, increasing with the range, the chances appear to be that in the long run the majority of men hit by them would be struck with not more than one pellet. And said pellet is but about one-third as heavy as a rifle or machine gun bullet and its speed hardly half as great, therefore its striking energy is not over one-tenth as much. Is it particularly difficult to imagine which could be expected to make the more serious wound? True, at quite short range a man may be hit with more than one pellet, but that also happens at times in the case of the machine gun, the main reliance of the Hun.

It seems that it should be hard for anyone who has had to do with such ammunition to believe that the percentage of fatalities or the suffering from wounds made by it could equal those made by some other weapons in common use. The shotguns probably cause considerable suffering at German Great Headquarters, for they should prove rather effective in putting men on the hospital list, as the spread of the charge greatly increases the chance of hitting under difficult conditions and makes it possible to hit several men at a single shot. And Hindy and Ludy hardly have any men to spare just now.

One point held in favor of the small-bore military rifle is that its use is more humane than a larger bore, its destructive effect being less; in other words, a man stands a better chance of recovering or not being permanently disabled when hit by the small-bore bullet. This idea represents one step in the direction of an ideal, where the soldiers are temporarily put out of condition to fight, without killing any or very few. Of course, such an ideal is utterly impossible of attainment in practice, at least at the present day; but there has been more or less tendency in that direction (at least up to the time when the "supermen" broke loose), a sample of which is the above mentioned rule from the Hague Convention. From this standpoint it would appear that buckshot loads are more humane than the modern rifle or machine gun ammunition, as the chance seems strong that the percentage of fatalities and permanent disablements would be lower in the case of the former.

The upshot of the mannter doubtless is that the shotgun is doing its part toward putting hors de combat the undesirables betwixt Switzerland and the sea, and Berlin is just a wee bit too busy just now to furnish her own forces with it. The worm has flip-flopped. If Germania were using the shotgun it would be legitimate enough, though. It would then appear to her almost as humane as a flag of truce. German officers have actually argued that the use of fire, gas or anything whatever is excusable if it tends to shorten the war—with them on the winning end of course; and their record speaks for itself.

Germany is also prattling about an "honorable peace." Her idea of such a peace has been amply demonstrated to be one that brings all you can possibly get, even if it be control of the entire world, regardless of how you get it—through hypocrisy, trickery or butchery, with the accent on the butchery.

Prussia can be expected to be at least a wee bit peeved at the Yankee Doodle outfit for heaving that man's-size monkey wrench into the works, just when she thought she had everything cinched, and evidently has not lost faith in the idea that there are always some people in shape to be fooled.

E. W. H.

Red Tape Procedures

To the Editor of the SCIENTIFIC AMERICAN:

I read with much interest your article, "How Finicky Inspectors Hold up War Work," and Mr. Howard R. Hutchinson's article, which is so near a parallel of my case that I am prompted to write my experience in offering my services for war work.

When the call came through the newspapers for ship builders I immediately took the matter up with that department giving my experience, stating at the time that I had not had any experience in building the deep water ships, but that I had designed, built and equipped and operated a number of light draught river types, that I also held a captain's license for inland waters of the United States to which I received a reply that when an opening occurred they would let me know. I am still waiting; I have heard nothing further from them.

It was not a question of my being without work for I had then and still have a much more pleasant place than I could expect to get in the shipyard, but I felt it my patriotic duty to offer my services where I thought I would be of the greatest service to my country.

I am ready now not to do my bit, but to do *my best* in any branch of the service they see fit and proper to place me.

I am not writing this with a view of getting placed in some essential work before I am drafted for service at the front, for I am not in the draft, having just passed that age, therefore, I can hardly be charged with having a selfish motive, but only to add my endorsement to yours and Mr. Hutchinson's articles showing that sometimes little men get in big jobs and the best results are not obtained. Or doubtless it was some petty clerk who handled my case and the head of that department has never known anything of it, and the shipyard has been deprived of one workman that they could have had had my case been handled differently.

If I was the only one it would not amount to enough to be discernible, but I dare say that there are many other similar ones.

W. W. WARD.

Dublin, Ga.

That German Automatic

To the Editor of the SCIENTIFIC AMERICAN:

I note in your issue of September 14th, mention and illustrations of an automatic pistol, fitted to a wooden holster or case, the same having been taken from a dead German officer.

It may interest you to know that this exact same weapon was carried by some Canadian officers in the Boer war, nearly twenty years ago, and was found by them to be very efficient, as the case, fitted as a gunstock as occasion required, gave an accuracy which only a rifle would have given and at the same time it could be utilized as a pistol with good effect. It is, however, particularly adapted to mounted men or officers as the case with the pistol inside is rather clumsy for a man on foot, not having the proper "hang" from the hip for an infantryman.

In utilizing one of these "guns" at target practice in the "paths of peace" I found it to be a very hard hitting, accurate weapon. Another example of there being nothing new under the the sun, the hellishness of the Hun to the contrary, notwithstanding.

FREDERICK RAND.

Toronto, Ont.

Spanish Influenza

How Does It Happen That the Present Epidemic Is So Fatal?

By Wade W. Oliver, Professor of Bacteriology, Long Island College Hospital, Brooklyn

THE present pandemic of influenza which has swept this country and within the short space of a few weeks exacted so sweeping a toll of disability and death has naturally aroused widespread scientific and popular interest. This outbreak coming at so crucial a time in the great world war and characterized as it has been by the severity of the disease, its frequently rapid course, and high mortality, has called forth many questions in the minds of the layman.

Foremost among these questions, is: "How does it happen that this epidemic of grippe is so fatal?" A complete and satisfactory answer cannot be vouchsafed, as yet, but perhaps a partial explanation is forthcoming.

The term "influenza" is Italian in origin and literally translated means "influence." It must be confessed that all of the influences governing the disease are not yet definitely known. The term "la grippe" was introduced by the French in about 1712 and has become accepted as the popular name of the disease.

The barber must guard against the breath of the man he is shaving and against the germs that lurk in his customer's hair

The severity of the present outbreak of influenza is not unique. The first epidemic of "la grippe" to appear in America, occurred in 1647, according to the researches of Noah Webster. It swept not only this country, but also the West Indies, reaping a toll of from 5,000 to 6,000 deaths in Barbados and St. Kitts alone. A second severe epidemic occurred in 1655 and a widespread epidemic occurred in the West in 1807.

Four great pandemics of influenza occurred during the last century, 1830-1833, 1836-1837, 1847-1848 and 1889-1890. This last worldwide outbreak of 1889, is said to have originated in the Far East and within a year it had visited practically every part of the known world. These outbreaks of disease have differed in severity and have spread according to the speed of human travel and intercourse. In 1909, 8,992 deaths occurred in England and Wales.

The course of the disease is fairly constant. The incubation period, that is the time elapsing between the entrance of the causative germs into the body and the appearance of symptoms of disease, is short, probably one to two days. The onset is sudden, the patient not infrequently showing marked prostration within a few hours. There may be a history of a slight sore throat or a feeling of being "out of sorts" for a few days previous, but many patients give no such history, passing from an apparently well condition to a state of most profound prostration within two to four hours. Headache and pains in the back, limbs and joints are initial symptoms. Along with this go a feeling of chilliness, fever varying from 101 degrees F. to 104 degrees F., and prostration. This prostration is one of the characteristics of the disease and is probably due to a rapid overwhelming of the body by poisons (toxins), produced by the rapidly multiplying germs. In a typical case, the reddened throat, sneezing and cough develop about three days after the onset of the disease. It is during this period of cough and sneezing that the disease probably is most contagious. If no complications develop the attack gradually subsides and within a week the patient begins to return to normal, although his cough frequently persists and he still feels "weak!" Another week of rest is advisable before the patient returns to his regular work.

The cases which develop complications not infrequently develop pneumonia, which causes the majority of the deaths. According to Keegan (*Jour. Am. Med. Ass'n*, Sept. 28, 1918, p. 1051), from 5 to 10 per cent of the patients in this present epidemic develop a very severe pneumonia.

Treatment, in so far as it lies within the hands of the layman, should be along two broad lines: (1) Prevention—to be attained by avoiding crowds, and also individuals affected with influenza. (2) Rest—go to bed immediately and call a doctor.

The deaths resulting from the present epidemic have been largely due to complications, among which pneumonia has been the most common. The cycle of developments in a fatal case may briefly be given as follows: The influenza bacillus, a tiny germ averaging about 1-25,000 inch in length, discovered in 1892 by Pfeiffer, gains entrance to the throat of healthy individuals most often through the fine droplets expelled by an influenza patient during the act of sneezing, coughing or loud talking. These droplets are given the name of "infectious droplets" because they contain, especially in the early stages of the disease, large numbers of the germs of "grippe." These germs, expelled into the air, may be breathed in by an individual in close proximity to the patient and thus passed via the aerial route from one person's body to another's. Because air infection is probably the most common method by which influenza is spread, the use of masks, often of gauze, to protect the nose and throat of healthy individuals is seen to be based upon rational principles. In this connection it is interesting to read an observation of Benjamin Franklin: "I have long been satisfied from observation, that besides the general colds now termed influenzas (which may possibly spread by contagion, as well as by a particular quality of the air), people often catch cold from one another when shut up in close rooms and coaches and when sitting near and conversing so as to breathe in each other's transpiration; the disorder being in a certain state." Along with the influenza bacillus are commonly associated the two germs which most frequently cause pneumonia, the so-called pneumococcus and the streptococcus. It is these two latter germs which have probably been responsible for the majority of the deaths in the present epidemic. Lodging upon the delicate mucous membranes of the nose and throat they find there a soil rendered especially favorable for their growth and prepared for them by the invasion of the influenza bacillus. After effecting a lodgment, the stage is set for a deeper penetration of the germs into the lower respiratory tract, with invasion of the lungs and setting up of pneumonia.

Germ-proof masks have invaded even the business office

The speed and universality of travel has been given as an explanation for the rapid spread of an epidemic. The reason why certain epidemics of a disease like influenza should be characterized by relatively mild symptoms, while other epidemics, such as the present one should be remarkable for the severity of its symptoms, is still obscure. However, certain factors may be considered to be relatively well established.

Considering germ diseases broadly, we may look upon infection as a process in which disease-causing germs not only invade the human body, but multinly and carry on their life process within the body, to the detriment of the latter. Infection, then, is the product of two factors, (1) the virulence, or invasive powers, or power of the germ to grow in the body and wreak injury, and (2) the resistance of the individual, that is the ability of the individual to prevent the germ from gaining a foothold within his body. Accepting as our basis of argument, then, the ground that infection is determined by the outcome of a battle waged between two living opposing forces, the attacking germ and the invaded body, we find that there are many factors, some relatively well established and others but little understood, whose sum total determines the fortunes of the battle.

(1) Resistance of the individual:

Different races, and even individuals, differ in their powers of resistance to a given germ. The negro is more susceptible to consumption than the white man; Jersey cows are more liable to tuberculosis than the Holsteins. Even individual differences in resistance are known. A whole family may be exposed to a given disease and certain members escape, while others contract it. Moreover, the resistance to disease of a given individual is apparently the result of the harmonious adjustment of a number of delicate factors, certain of which exhibit natural fluctuation and other of which may be modified by

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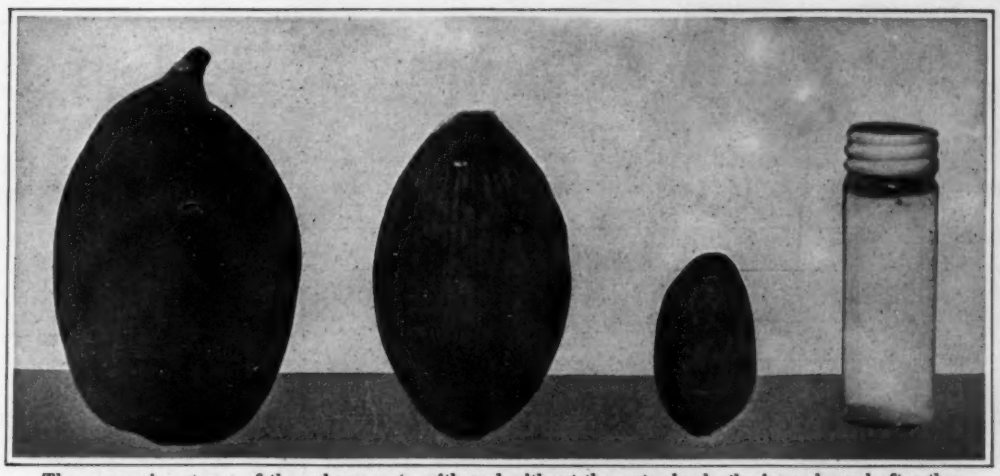
The subway is a good breeding place for germs, hence ticket sellers must take precautions

Because he works in the patient's mouth, the dentist must wear a protecting mask

A New Source of Vegetable Fat

VARIOUS articles have from time to time, appeared in the trade periodicals and in Government bulletins treating upon the subject of the oil seed-bearing palms of America. In almost every case these writings have excited inquiries for further information. More especially at this time of a world-wide scarcity of edible fats has attention been drawn to the immense forests of oil palms close to our doors. Central America, from Mexico to Colombia, is the habitat of many species of oil seed-bearing palms.



The successive stages of the cohune nut: with and without the outer husk, the inner kernel after the removal of the hard shell, and the refined cohune oil

In December, 1917, the writer received a commission to investigate the possibilities of the Attalea cohune as a source of oil on a commercial basis in British Honduras. For many years these nuts have been exploited by the natives of British Honduras as a source of fat for culinary purposes, as well as for lighting their homes. There is hardly a traveler who has gone into the interior of the country who has not returned with reports of the immense areas covered by the corozo or cohune forests, especially in the northern districts of this colony. Attempts were made as far back as 1869 to make the cohune an important article of commerce. Later several English concerns at different times attempted to make the business profitable, but owing to their lack of knowledge and limited funds for experimental purposes, they have followed their predecessors in failure.

In recent years the growing value of all edible oils has stimulated American capital and ingenuity to attack the difficulties encountered by the men who first blazed the way.

In Central America the tree of greatest importance from an oil standpoint is the Attalea cohune, though there are many different oil seed-bearing palms. In the earlier stages of its growth it is by far the most beautiful and most graceful of all the forest trees of the tropics. It is easily distinguished from any of the other members of the palm family. Its immense, almost erect, leaves attain a length of 40 feet. The upper third of the leaf droops slightly, giving the whole tree the appearance of a giant feather duster. The fruits are borne in huge clusters, having the appearance of enormous bunches of grapes. A single bunch often weighs upwards of one hundred and fifty pounds. The trees bear from one to three, sometimes four, clusters. In the months of April and May the trees put forth a woody spathe covering the blossoms. As the bud swells, the spathe splits down its entire length and a mass of creamy white flowers breaks through, filling the air with a delightful perfume. After about five days, the flower fades and falls to the ground like a tiny snowstorm. The fruits grow rapidly in size for about five months when they have the appearance of being full. If the bunch is cut and a fruit is examined at this stage, it will be found to consist of, first, a tough, fibrous outer covering of a greenish brown color. This is locally known as "husk" and contains considerable oil. Inside the "husk" is the "shell" which is probably the hardest and toughest nut shell in the world. A pressure of 1,800 pounds is necessary to break it. The difficulty of cracking this shell has been the stumbling block to the successful exploitation of the American palm nut industry. Many kinds of breakers and crushers have been tried with the object of cracking the shell without crushing the enclosed "kernel." Various types of rock crushers were used. They broke the shell, but in so doing crushed the kernel and in crushing the kernel, partially pressed out the oil which, upon contact with the warm and humid atmosphere, turned rancid, spoiling the product for market.

The natives' method has been, after proper treatment, to crack the nut between two stones. They become very dexterous; with a peculiar blow the shell is shattered and the kernel freed whole.

Enclosed in the shell are found from one to three kernels about one and a quarter inches long by seven-eighths of an inch through. The kernel contains from sixty-five to seventy-two per cent of a hard, white fat with a melting point of about sixty-eight to seventy-seven degrees Fahrenheit. This fat is almost identical with the fat from cocoanut copra and for some purposes is superior to it.

If the bunch of fruit is cut before fully ripening, which takes about nine months, a small cavity is found in the kernel filled with a watery liquid similar to that of the edible cocoanut. At this stage, the nut is not at its best for the production of oil. Experience has taught the native to allow the nuts to ripen and fall from the stalk before gathering, as the fully matured nut, while still on the stalk, cannot be distinguished from the undeveloped nut of seven or eight months. Men, women and children gather the nuts into piles and place them in patios or cleared spaces in the groves beside the roads. The nuts are allowed to lie upon the ground from one to three months exposed to the sun, when they are ready for cracking. At this stage of the operation the cavity in the kernel has disappeared and the kernel is solid and tough.

A study of the native methods has shown that the justification for the long, slow drying period is not only to allow the kernel to loosen itself from the shell, but also to toughen the kernel and make the shell more brittle. Improved methods developed by a company now engaged in putting the cohune on a commercial basis have shortened this period considerably.

The nuts, after gathering, are hauled to the nearby waterside and in large barges are towed to the plant. To facilitate drying, they are passed through a rotary husker which removes the pericarp or husk. They receive a preliminary drying on the patio for a few days and are then transferred to tempering sheds, with

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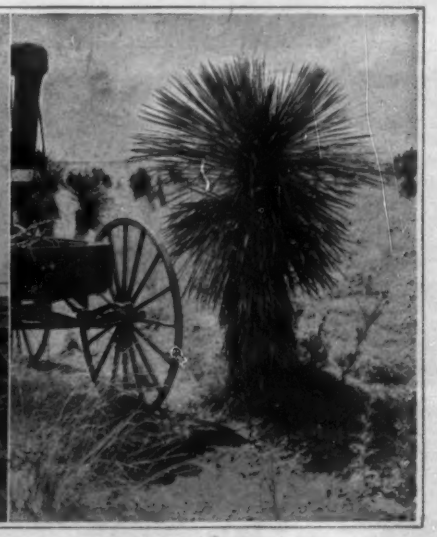
Gathering and preparing yucca to feed cattle who would starve without it

Chopping and shredding yucca for cattle feeding



A good-sized yucca plant

A Desert Feed for Drought Seasons

A FEW years ago stockmen in the Southwest might have scoffed at the idea of using soapweed and bear grass as cattle feed. When periods of drought came around they either shipped their cattle to a more favorable State or imported vast quantities of feed from States to the east and north. But during the past two years, being badly affected by drought and finding the supply of other feed high-priced and difficult to obtain, they have utilized with surprising success the supply of the different species of yucca surrounding their ranches. Not only have these plants been of real value as a supplement to regular feed, but it has been discovered that cattle actually live entirely on the food contained in these yuccas.

Two years ago ranchmen would have been glad to get rid of these tons of what they considered worthless vegetation surrounding them on nearly every side, but it has now been discovered, partly through representatives of the Department of Agriculture who are conducting investigations in those localities, that these feeds are of excellent value and in drought periods will save the loss of thousands of cattle.

The drawback to the utilization of these feeds in the past has been the inability to put them in proper condition for feeding. Some efforts have been made toward this end, and many ranchmen have experimented at one time or another in chopping them up into cattle feed. In many cases, however, disastrous results came from this course, since the pieces of feed often were swallowed whole and resulted in impaction, or lodgement in the digestive tract, and consequent loss. During the last year several machines have been devised which slice or shred these materials up into thin pieces a few inches long. Cattle take to this form of feed readily, and greedily eat up the pieces that fall from the cutting machine.

Representatives of the Department of Agriculture estimate that, even allowing for feeding of a concentrate such as cottonseed meal, the cattle can be kept in good condition during a drought season at a cost of approximately five cents a day an animal. The cost of preparing an adequate ration of yucca feed runs less than two cents an animal a day. Machines designed for this work are built on the same principle as a silage cutter or a wood pulping "hog." The machine consists of a cylinder carrying numerous teeth or knives which, rotating before a cutting block, shred or slice the feed into small pieces.

Not only are bear grass, sotol, and soapweed of value in feeding, but numerous other similar relatives of the yucca family may be utilized for feed. Soapweed and bear grass, however, have the great advantage that they are abundant throughout most of southwestern Texas, southern New Mexico, and southeastern Arizona, and for that reason ranchmen have little trouble in securing this feed. The fact that the soapweed and bear grass are the most readily replaced of any of the yuccas makes it quite possible that a permanent source of feed will be always available. Many of the yuccas, once cut, do not come up again. Consequently when the present supply is exhausted it would be necessary to replant the varieties; but soapweed and bear grass renew themselves in periods running from three to ten years, and consequently in drought seasons a supply of them would always be available.

School of Archæology

A BRITISH School of Archæology is to be founded at Jerusalem under the auspices of the British Academy. The school is to be conducted as a research body, to carry on excavation investigations, and as a training school for archæologists.

Mechanical Equipment of the Farm

Latest developments in agricultural machinery and practical suggestions for the farmer

Conducted by HARRY C. RAMSOWER, Professor of Agricultural Engineering, Ohio State University

Results of Ohio Tractor Demonstration

THE accompanying table gives the results of a fuel economy test made on twenty different types of tractors while plowing side by side in field of light clay loam where there was quite a rank growth of clover covering the ground.

The fuel was carefully weighed into the drained tank of each tractor as it stood upon its land. An inspector followed each machine, to observe its operation, to see that a uniform depth of plowing was maintained, and to take time out for any cause making stops necessary. When the land assigned each tractor (which in all cases was 2.07 acres), was completed, the fuel remaining in the tank of each was withdrawn and weighed.

The reader should constantly bear in mind that a single test of any tractor on so small an area is not very valuable. The average results of several tests is worth while. From the tests shown it is seen that the seven machines burning gasoline consumed an average of 3.25 gallons of fuel per acre, at a cost of 81 cents. The thirteen machines burning kerosene consumed 3.5 gallons per acre at a cost of 53 cents, there being a difference of 28 cents per acre in favor of kerosene. In connection with the difference in fuel cost the much debatable effect of the use of kerosene on the motor and on lubrication should be taken into consideration.

The 2-bottom rigs plowed an average of .67 of an acre per hour, while the 3-bottom rigs plowed .96 of an acre. It will be seen that each averaged just about ⅓ acre per hour per bottom, which is just good average work under average conditions.

As an indication of the trend of tractor design it will be seen that 15 of the 20 tractors had 4-cylinder motors.

RESULTS OF OHIO TRACTOR DEMONSTRATIONS

No. of Tractor	Type	Rating	Plows	Kind of Fuel	Fuel Consumed Per Acre		Cost of Fuel* Per Acre	Acres Plowed Per Hr.	Depth of Plowing
					Gas	Kero.			
			Ins.		Gals.	Gals.			Ins.
1	4 cyl.	10-20	2-14	Gasoline	3.41	.....	$0.852	0.696	8
2	2 cyl.	9-18	2-14	Gasoline	3.18	.....	0.795	0.730	8
3	4 cyl.	15-30	3-14	Kerosene	0.08	4.11	0.574	1.05	8
4	4 cyl.	9-18	2-14	Gasoline	4.66	.....	1.165	0.43	8
5	4 cyl.	9-18	2-14	Gasoline	2.46	.....	0.615	0.739	8½
6	4 cyl.	12-20	3-14	Kerosene	0.06	4.47	0.618	0.771	8
7	4 cyl.	9-18	2-14	Kerosene	0.49	3.03	0.536	0.48	8
8	4 cyl.	10-20	3-14	Kerosene	0.66	4.41	0.955	0.73	8
9	1 cyl.	10-20	2-14	Kerosene	.....	3.42	0.461	0.673	8½
10	2 cyl.	10-20	2-14	Kerosene	.....	3.76	0.507	0.569	8
11	4 cyl.	12-20	2-14	Gasoline	3.00	.....	0.75	0.83	8
12	4 cyl.	15-25	3-14	Kerosene	.....	4.00	0.540	0.786	8
13	2 cyl.	12-24	3-14	Kerosene	0.07	2.35	0.334	0.936	8
14	Form A	Tractor	1-16	Gasoline	3.37	.....	0.842	0.375	8
15	4 cyl.	12-25	3-14	Kerosene	0.06	3.02	0.478	0.92	8
16	4 cyl.	12-25	3-14	Kerosene	0.082	2.85	0.406	1.05	8
17	4 cyl.	12-25	3-14	Gasoline	2.70	.....	0.675	0.97	8
18	4 cyl.	12-25	3-14	Kerosene	0.45	2.61	0.466	1.01	8
19	4 cyl.	.....	2-14	Kerosene	0.03	3.99	0.546	0.90	8
20	4 cyl.	12-20	3-14	Kerosene	0.07	3.55	0.491	1.38	8

*NOTE: Gasoline was figured at 25 cents per gallon and kerosene at 13½ cents. The weight of the gasoline was 6.175 lbs. per gallon, kerosene 6.7 lbs. per gallon.

Fuel economy tests of farm tractors

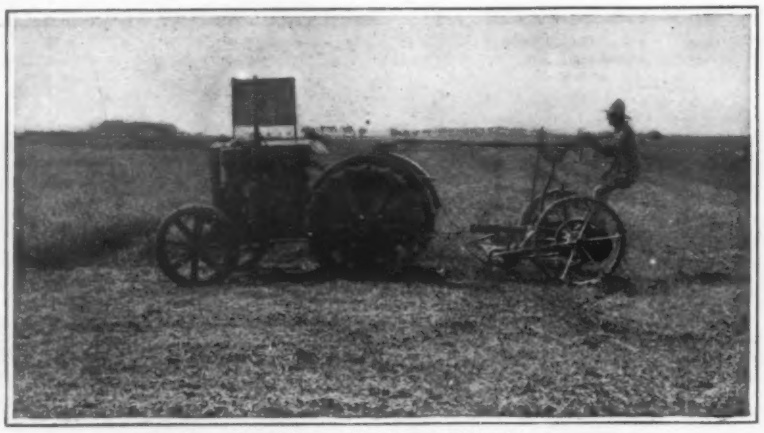
Tractor Operation Data

THE Division of Farm Mechanics, University of Illinois, recently secured some tractor data from Illinois farmers who had kept accurate record of the cost of operation of different types of tractors for the period of one year.

Fourteen operators reported on three-bottom rigs drawn by kerosene burning motors. The average of these 14 replies, which were considered reliable and complete, showed the following results for an average tractor: The original cost of the tractor was $797.57. The tractor had been in use two years. It was used 42.4 days per year, during which there was 16.29 hours of trouble. The fuel cost for the year was $60.28, while lubricating oils and greases cost $19.45. The repair cost was $38.16, with a miscellaneous cost of $7.54. The depreciation at 20 per cent was $159.51 while interest amounted to $28.71, giving a total cost per year of $313.65.

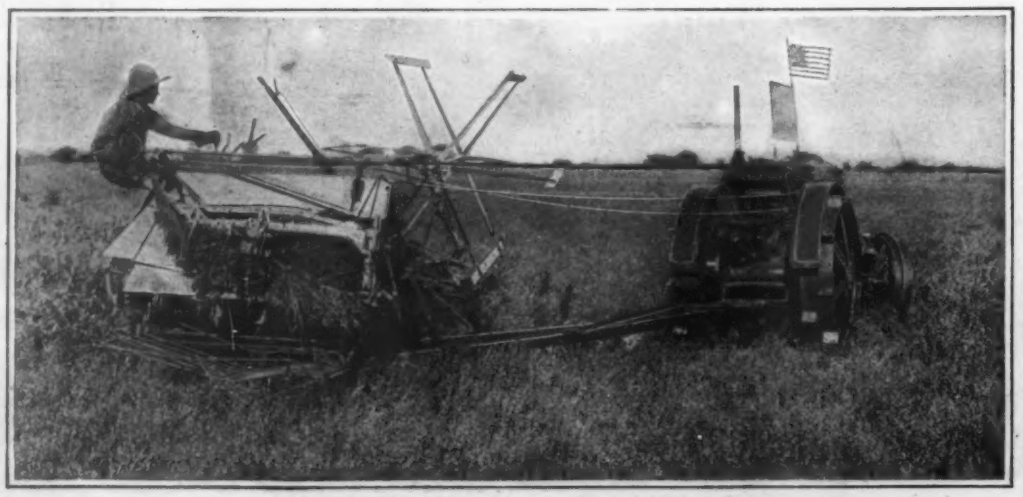
This tractor was used on a farm averaging 258.57 acres on which 213.63 acres were cropped. On this farm there was an average of 89.13 acres of corn, 66.25 acres of oats, 17.3 acres of wheat and 35.93 acres of hay. There were 9.5 horses used before the tractor was purchased and 7.35 horses after tractor was used. A little more than two horses per farm were thus displaced. The data indicated that without a tractor the average man farms 22 crop acres per horse, while with the tractor he farms 29.7 crop acres per horse.

One farmer, operating 320 acres, reported that he was able to dispense with one hired hand, after getting the tractor.



The four-wheeled gasoline horse hitched to a mower

For road use the tractor is fitted with rubber tires



Making a turn with the gasoline horse

A World Demand for American Tractors

ONE of the most urgent appeals after the war will be for thousands of farm tractors to replace the men and the horses that have been used up in the struggle. Soon after the beginning of hostilities practically every horse in Europe was seized and placed in war service, and during the last four years large numbers of horses have been purchased by France, England, and our other allies. The United States and Canada have supplied more than two million horses and mules; many others have been furnished by Spain and South America. Most of the capable male farm workers in the belligerent countries are with the armies, and European food production is carried on by women, children, and old men. In England the use of tractors has resulted in larger crops during the war, but the other countries have lacked sufficient implements to maintain their normal yield.

Receiving high prices for his products the farmer of today is prospering beyond all precedent. Agriculture as an industry has sounder credit and greater purchasing capacity than any other. The farmer is not only short of horse and man power, but his machinery and tools are wearing out. He has money in the bank, but it is next to impossible for him to buy new implements or repair parts for the old. As soon as the war is over there will be a tremendous demand for modern farming appliances of all kinds, and price will not be so important a factor as quick deliveries. It is estimated that France alone will need 60,000 tractors.

Right here in the United States farmers will be quick to purchase them to make good the shortage of men and horses; they bought 34,000 in 1916. The heaviest volume of orders, however, will be from Europe, where it is calculated that not more than 5,000 tractors a year can be made locally, outside of Germany. To handle this trade our manufacturers will have to increase their producing capacity. They should be ready for a large backed-up demand for all classes of farm machinery and prepared to make immediate shipments when peace makes cargo space available.

Steering and Controlling Devices for the Four-wheeled Tractor

ONE thing which has prevented the completest use of the tractor on the farm is this—in order to operate a grain binder, a mower, a manure spreader, etc., it was necessary to have one man on the tractor and another on the machine. Obviously this was a waste of man power, and it has led to the invention of special tractors which can be hitched to the agricultural machine in much the same way as is a horse. The tractor can then be steered and controlled with reins or with a universally jointed shaft. Some of these machines have already been pictured in past issues of the SCIENTIFIC AMERICAN. The accompanying photographs illustrate a different type of tractor from those previously published. The pictures show the mechanical horse performing a number of operations, and demonstrate the wide variety of service to which it can be put. It is clearly evident that the operator can now control both tractor and machine in a satisfactory way.

Note the rubber tire equipment for the light weight tractor shown drawing the two wagons. Rubber tires will permit of greater speed on the road and at the same time will add much to the life of the tractor.

A Steam Laundry That Goes With Our Army

STARCHED white shirts and stiff linen collars being unknown to our soldier boy in France, the problem of handling his laundry is simplified by a great deal. Nevertheless, he has laundry to be handled, especially after spending several days in the muddy and vermin-infested trenches.

One of the machines now used in laundering the clothes of the American soldiers is shown in the accompanying illustration. It is a steam laundry unit, mounted on a typical English road locomotive provided with rubber tires. Two steam chests at the rear receive the clothes to be washed and sterilized, after which boiling water is introduced.

Copyright, International Film Service

Steam laundry employed by the American troops in France

Shaping a Wooden Rudder Stock by Machinery

WITH the revival of the wooden shipbuilding industry, history has indeed repeated itself. But the repetition is only in a very general way, for there have been introduced numerous innovations in wooden shipbuilding of today that brand it as a most modern industry, comparable to that of steel shipbuilding. Modern methods and machinery have done much to place it on a high plane of efficiency, in marked contrast with the hand work of former days.

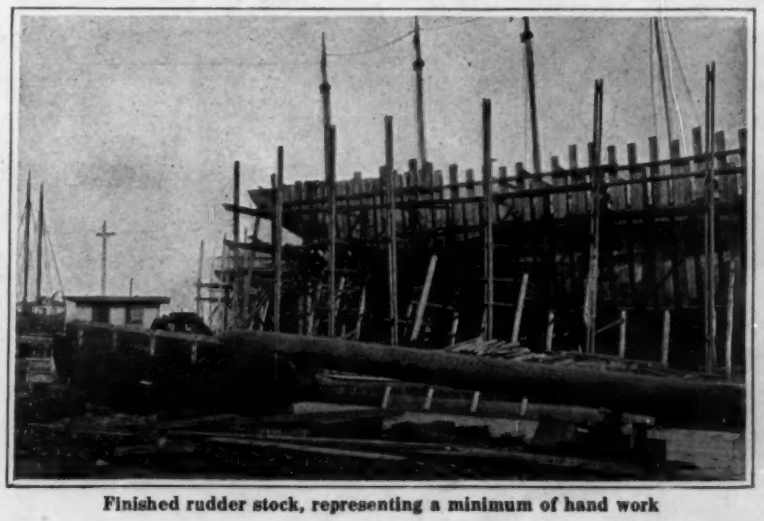
Typical of the modern methods obtaining in wooden shipbuilding yards of the present time is the shaping of a rudder stock, as depicted progressively in the four accompanying illustrations. It will be noted that the iron bark rudder stock, after leaving the saw, is placed on the carriage of a beveling machine, and sent through the machine to receive the first rough shaping. This consists of placing the stock on blocks sawed to hold it at 45 degrees, and the carriage is run forward and the cutting done on a top beveling head. As it is especially hard wood, comparatively light cuts are taken, and each time the carriage is reversed, the top beveling head is lowered slightly by power. A dial on the top beveling head indicates the exact position of the rotary knives, and another cut is taken. This operation is continued until a cut of the desired depth is obtained, when the rudder stock is turned so as to bring another part into proper position with relation to the cutting knives.

Eight sides are cut on the rudder stock in the first phase of the work. The second phase changes the eight sides to 16 sides, while the lower part is beveled two ways and the sides surfaced. In this form the rudder stock is roughly finished, and requires only a minimum of hand work with suitable tools in order to give it the finished form depicted in the last illustration.

Square-shaped rudder stock as received from the saw

After eight cuts have been made with the top beveling head

Eight cuts transformed into sixteen in the same manner



Finished rudder stock, representing a minimum of hand work

The Autumnal Coloration of Leaves and Leaf-fall

WE are approaching the season of the year when Nature exhibits two striking phenomena which would be more fully appreciated if they were more clearly understood. The two phenomena referred to are the autumnal coloration of leaves and the subsequent leaf-fall. These two processes are closely associated. During the leaf's period of greenness it has been Nature's great laboratory for the manufacture of various materials. We do not commonly associate the supply of nitrogenous and carbonaceous foods which we daily consume with the work of the leaves, but it is to them directly or indirectly that we are indebted for these materials as well as for a long list of other daily necessities ranging from flour and sugar to lumber and coal.

Leaves fall in the autumn, not because they have been killed by the frost or because they are forcibly torn from the trees by heavy winds, but because they have served their purpose to the tree and have been discarded by it. Botanists tell us that their fall is due to the interposition of a separating layer which is formed during the period of vegetation and which cuts across the articulation of the leaf-stalk. Exactly how this process takes place is of less consequence to us than the knowledge that it is a natural process in the life and growth of the tree and not merely an accidental condition. When the leaf falls the vessels which connected it with the branch become filled with brown masses of wound-mucilage which has come from neighboring cells into the cavities of the vessels and plugs them up.

Before the leaf falls from the tree all the elaborated materials which it contains that can be of further use are mobilized and stored in their proper places in the body of the tree. After these valuable materials have been removed from the leaf, what remains is devoid of the active green chlorophyll and the cells are nearly empty as may be seen if the leaf is held up to a bright light or is examined in section under the microscope. The yellow granular bodies of disorganized chlorophyll which remain give the predominating yellow color to autumnal foliage. The reds and browns are produced by various decomposition products which comprise the cell contents and which are formed under the conditions resulting from the maturing of the leaf.

It is fitting that the leaves, after having accomplished their valuable work, should call attention to its completion by putting on these gay colors. In fact, this story about the changing colors of leaves and their fall indicates again the efficiency of Nature in most things.

German Chemical Industry in 1917

THE year 1917 was for the German chemical industry a period of intense activity, far-reaching achievement, and profitable enterprise, says the German press. The tasks which the industry had to accomplish in the military and economic interests of the country alike continue to expand, with the result that works had to be enlarged and capital increased. All the concerns in the great chemical combine raised their capital toward the end of 1917, before the stringent regulations against capital increases came into force. The existing shareholders were given the option of taking up the new shares at 107 per cent, a figure which, at the current stock exchange quotations, allowed a good profit on the transaction. The seven companies in the combine raised their capital by 178,600,000 marks to 353,400,000 marks (at normal exchange the German mark is worth $0.238 United States gold), partly with a view to the erection of new plant (especially for the extended production of nitrates) and partly also in order to water down their stock and check the rise of dividends.

During the year work was abundant and the profits were therefore good. But the profits shown in the balance sheets of the companies do not exhaust the whole of the gains. In addition to the visible profits there were also invisible profits in the form of sums partly written off and partly put to reserve, including considerable amounts set aside for the war-profits tax. It should also be noted that the output of the various members of the combine is not quite entirely pooled. For a certain fixed period the profits of certain branches of their work do not come into the general balance sheet. Thus, in the case of the Hochst concern the production of calcium carbide, nitrolin, and certain products made therefrom, and in the case of the Badische Anilin group the production of synthetic ammonia and the inorganic nitrates made from it, are so excluded.

For the six companies surveyed by the *Frankfurter Zeitung* (Hochst, Badische Anilin, Bayer, A. G. fur anilinfabrikation, Griesheim, and Weiler-ter-Meer) the gross profits for 1917 were 194,900,000 marks, being 41,400,000 marks in excess of those for 1916. The amounts written off totaled 63,400,000 marks, showing an increase of 18,300,000 marks over the figure for 1916. The *Frankfurter Zeitung* observes that doubtless further considerable sums must have been written off which do not appear in the balance sheets. The German chemical works have always adopted the policy of making ample provision under this head; in fact, it is to this policy that their great strength is due. During the war they have continued this course, taking into account on the one hand the depreciation of plant resulting from intensive day and night work, and on the other hand the uncertainty of the future and the necessity of assuring a smooth transition to peace conditions. The net profits of the six concerns rose during 1917 by 14,000,000 marks to 110,000,000 marks; but as the capital involved had been increased, a lower dividend was declared for all the companies save one, which declared the same dividend as in the preceding year. The average dividend for 1917 was thus 18.78 per cent, as against 24.84 per cent for 1916; the actual amount paid out in dividends was 63,100,000 marks as against 53,070,000 marks.

These figures show that the chemical concerns have succeeded in financially consolidating themselves so thoroughly as to inspire confidence in a smooth transition to peace conditions. This confidence is all the more firmly founded in view of the agreement entered into between the chemical works and the explosives groups for the purpose of defining their respective spheres of activity in the period after the war. While this agreement will eliminate competition at home, the German chemical industry will have to reckon with the determined efforts of the chemical industry in enemy countries to oust their German competitors from the world markets. The *Frankfurter Zeitung* expresses the hope that the German chemical industry may emerge victorious from the struggle.

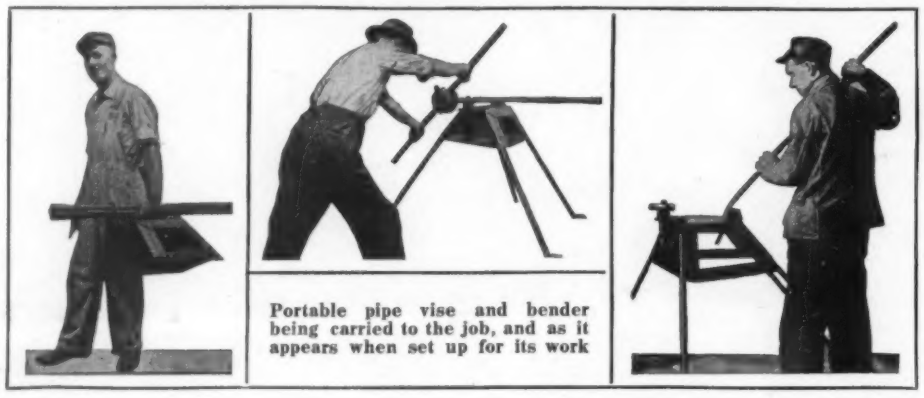
Inventions New and Interesting

A Department Devoted to Pioneer Work in the Arts

A Portable Vise Stand and Pipe Bender

WHILE there are many types of vise stand and pipe bender available for use in shops, until recently the workers out on jobs have been experiencing considerable difficulty in this connection. In many cases the men have had to go to the shops in order to thread and bend pipes, for want of portable tools.

Now there is available an ingenious portable vise stand and pipe bender which is so light that the workman can readily carry it about to the very spot where pipe work is to be undertaken. In its disassembled form the outfit is quite compact. When set up it is sufficiently rigid to allow a large variety of work to be done, such as cutting threads or bending pipe to any desired angle.



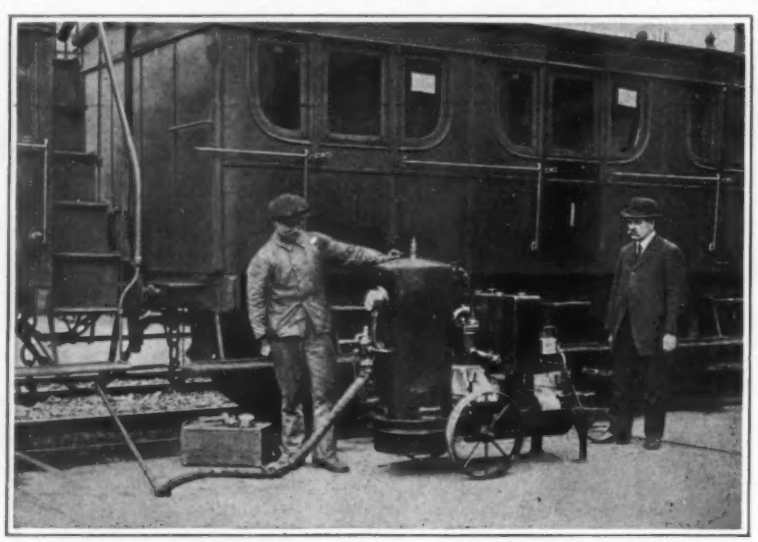
Portable pipe vise and bender being carried to the job, and as it appears when set up for its work

A Portable Compressor for Testing Air Brakes

BEFORE a train can start on its journey, the maintenance service must inspect all the cars in order to make sure that the wheels, axles, springs, couplings and other parts are in good shape. In particular, it is necessary to be certain that the brakes are in working order. Heretofore, this last has been a very slow process; for there were available in the terminals only stationary air compressors. It was accordingly necessary to bring the cars to these in order to proceed with examination of the brake connections.

A French inventor, M. Campagne, has just constructed an apparatus, which includes a motor and an air compressor mounted on a hand truck, for the rapid execution of brake tests in the station, after the train is made up and immediately before its departure. As our figure shows, the motor is a vertical one, of automobile type. It is of one cylinder, water-cooled, developing five horse-power; the bore is 3.6 inches, the stroke about 4 inches, and the maximum speed 1,200 revolutions per second. The compressor is geared down from the motor to operate at a speed of 650 revolutions. Motor and compressor are supplied with fuel from a common reservoir, and employ a single radiator. All parts which can possibly be made so are interchangeable, so that there is little or no probability of the assembly being put out of commission for any length of time by a breakdown.

The French railroads which have tried out M. Campagne's apparatus report that with it, one man can test all the brake connections of a train in a half hour, instead of twice that time, as formerly; and the tests can be conducted in the absence of an engineman, which was not the case when the several connections had to be brought opposite a stationary compressor. The device has been adopted by the State Railroads, as well as by the Orleans and the Eastern lines.



Testing brake connections by means of a travelling compressor which can be brought to the train after it is made up

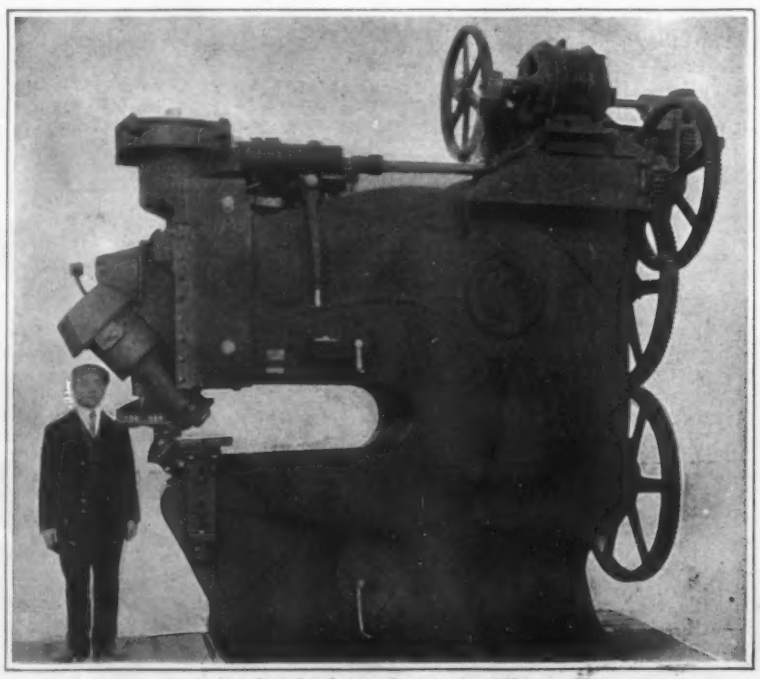
An Electric Rotary Shear

THE accompanying illustration shows an electric rotary shear developed at St. Marys, Ohio, which does in one operation, with one handling of the material, work which has heretofore required several machines, some handwork, and consequent repeated handlings of the material.

The machine shown will shear straight lines in a plate of steel more quickly than any other apparatus, save only a long-bladed squaring shear or gate-shear that cuts the full length of the sheet at one stroke. As compared with cutting with the ordinary type of horizontal-shaft, vertical-cutter rotary shears, attention is called to the fact that such shears are almost universally made with but one speed, and that a very slow one. Curved lines can not be cut with them; and the cutters being large in diameter and straightfaced, it is extremely hard to guide the sheet in a straight line. If it is started the least bit out of line, it is difficult to get back on line and stay there; but with the electric shears the operator easily controls this feature, thus cutting rapidly and accurately.

Each machine is provided with three speeds, any one of which may be had instantly by mere movement of a lever. In cutting irregular work of difficult pattern in large sheets low speed is used; for work of medium character the second speed; and in straight work or easy curves the high speed. In addition to the advantage in cutting straight lines, this shear cuts serpentine shapes and the most irregular zig-zags. It cuts openings of any shape without cutting in from the side of the sheet, and will cut in one end of the sheet even when the other end is too long to swing through the throat of the shear.

It will be seen that the sheet or plate does not have to be fed into the machine by a gang of men, as is necessary under old methods. Both cutters are driven, and the sheet is automatically drawn through the machine, rapidly and continuously, cutting a square true edge in one passage.



An electric shear of great flexibility

Recent Patent Decisions

Discontinuance of Suits.—In a recent adjudicated suit for infringement of letters patent, No. 1,081,508, for improvements in dispensing apparatus for paper drinking cups, issue was raised as to leave to discontinue an infringement suit without prejudice. It was held that this was properly denied. Where a complainant had obtained a favorable adjudication on its patent in one district which entitled it to a preliminary injunction as of course in a pending suit in another district, it was not error for the court to refuse permission to discontinue the second suit without prejudice.—*Individual Drinking Cup Co. v. Union News Co., U. S. C. C. A. of N. Y.*

Revision of Claims.—The patentee of reissued letters patent appeals from the decree of the lower court in a suit brought against the defendant to restrain infringement of the Cole patent, No. 14,000, for a label adapted to be detachably secured around a package having display matter relating to the contents of the package on its outer face, and the inner face bearing useful printed matter, held, not infringed by defendant's device for a detachable label. Where a patent was not obtained until after numerous rejections and amendments of claims on reference to prior patents, it is limited to the precise form and language of the claims allowed.—*Cole v. Ed. G. Hooksratten Cigar Co., U. S. C. C. A. of Cal.*

Conflicting Constructions.—Imitation gold leaf, which is the subject of patent, was admittedly sold by defendants, and the infringement found consisted in the vending of one lot or batch of leaf, and the evidence of infringement then considered related to that special lot. Pending this accounting, the plaintiff brought another action against these defendants, based upon the sale of another and presumably different lot of leaf. The fact of such second suit is proof of plaintiff's opinion in respect of that difference. The lower court necessarily held the claim valid, but found no infringement, and appellate court sustains the decree to that effect. The meaning given to a patent claim, as construed by the same court in successive suits, attaches instanter, and, if there is any difference between the construction given it in the first and in a subsequent suit, the latter must control.—*Oriental Tissue Co. v. Louis Sejonge & Co., U. S. C. C. A. of N. Y.*

Costs in Infringement Proceedings.—There is no fixed rule governing the allowance of costs made on an accounting for infringement of a patent, but each case must be disposed of on its own merits. Such costs rest in the discretion of the court, and, while in some instances the courts have considered it proper to require unsuccessful plaintiffs to pay the costs, yet cost assessment is discretionary with the court.—*Individual Drinking Cup Co. v. Public Service Sup. Co., U. S. C. C. A. of N. Y.*

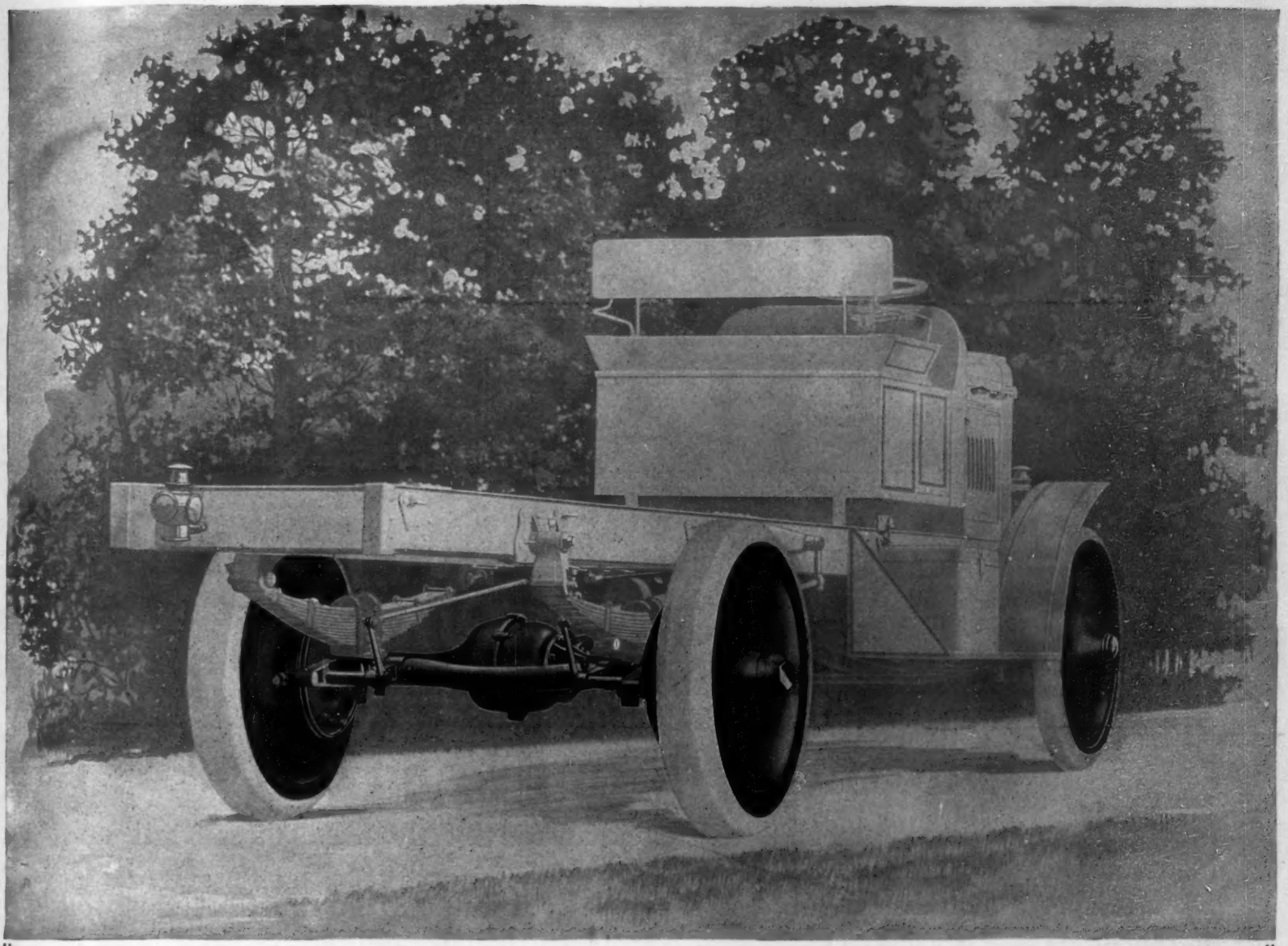
Two Patents or One?—Where an inventor at the same time devises a container for electric light of pleasing design and a mechancial contrivance conveniently united with an esthetic cover, he has made two inventions, and, though he at first secures only a mechanical patent, he may, within the two-year period, procure a design patent without violating the rule against double patenting.—*Bayley & Sons v. Standard Art Glass Co., U. S. C. C. A. of N. Y.*

Success as Evidence of Invention.—Where a device in an art crowded with a multitude of similar forms secures an immediate and notable success, that in itself is sufficient evidence of invention.—*Luminous Unit Co. v. Freeman Sweet Co., 249 Fed. 876.* But the fact alone that a patented article has been commercially successful is an unsafe test of invention.—*National Sweeper Co. v. Bissell Carpet Sweeper Co., U. S. C. C. A. N. Y.*

Scope of New Assembly.—Where all patentee did was to invent a way in which old mechanical means could be assembled for the purpose of doing something that had previously been done through different mechanical means, patent should be narrowly construed—that is, inventor is entitled only to range of equivalents commensurate with the scope of his invention. The Gibbs improvement patent, describing improved assembling of mechanical means for more securely holding in place terminal plates connected with electrical fuse wires, which serve to break circuits under abnormal conditions, held valid.—*Economy Fuse & Mfg. Co. v. Chase-Shawmut Co., U. S. C. C. A.*

A Strange Pair of Industrial Bedfellows

AN interesting application of the conservation idea is seen in the report from Iceland that waste heat is there being utilized to bake bread. The connection between bread- and gas-making might at first blush seem a far cry; but the city council of Reykjavik has begun the operation of a special bakery in conjunction with the municipal gas works, whereby much of the heat which formerly escaped up the chimney of the latter is utilized in the ovens of the former. It is expected that before long all the black bread consumed in the city will be baked in this establishment. Three-pound loaves are completely baked in three hours and other sizes in proportionate time.



Typical 2-ton truck showing Clark Internal Gear Axle and Clark Disc Steel Wheels as equipment.

Out of the Mouth of Hell

our boys come, nerve-racked, tense, exhausted by their sleepless vigil and harassed with tragic memories.

Rest they will have, but rest is not re-creation. Mind must relax as well as body. They must forget awhile, must turn their thoughts into their normal course before facing anew the horrors of the first-line trenches.

Courage they have always, but we can put fresh heart into them; we can restore the high spirits of youth and send them singing into the fray.

They Are Fighting for You—Show Your Appreciation

When you give them arms, you give them only the instruments of your own defense; when you give for the wounded, you give only in common humanity; but when you give to the Y. M. C. A., you are extending to the boys the warm hand of gratitude, the last token of your appreciation of what they are doing for you. You are doing this by showing your interest in their welfare.

The Y. M. C. A. furnishes to the boys, not only in its own "huts"—which are often close to the firing line—but in the trenches, the material and intangible comforts which mean much to morale. It furnishes free entertainment back of the lines. It supplies free writing paper and reading matter. It conducts all post exchanges, selling general merchandise without profit. It has charge of and encourages athletics, and conducts a "khaki college" for liberal education. Its religious work is non-sectarian and non-propagandist. It keeps alive in the boys "over there" the life and the spirit of "over here."

GIVE NOW—BEFORE THEIR SACRIFICE IS MADE

YMCA

Seven allied activities, all endorsed by the Government, are combined in the United War Campaign, with the budgets distributed as follows: Y. M. C. A., $100,000,000; Y. W. C. A., $15,000,000; National Catholic War Council (including the work of the Knights of Columbus and special war activities for women), $30,000,000; Jewish Welfare Board, $3,500,000; American Library Association, $3,500,000; War Camp Community Service, $15,000,000; Salvation Army, $3,500,000.

YMCA

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The Publishers of SCIENTIFIC AMERICAN

The Current Supplement

MOTION of a body is unintelligible except in reference to another body; but when we consider phenomena outside our earth, which is rotating about its axis while revolving about the sun, itself rushing through space in a universe in which nothing probably is at rest—how are we to find some frame of reference? These are the problems of relativity. A special application of the theory is discussed in *Gravitation, and the Principle of Relativity* in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2235, for November 2d. *The Dove of Peace* tells of the various breeds of birds used as war messengers, their development and training. It is illustrated by two photographs. *The Daikon* is a Japanese plant that is used as a vegetable, or as forage for animals. It is described and illustrated in this issue. The article on *The Invasion of the Trenches by Rats* is concluded. *"La Guerre Pour Le Minerai De Fer,"* is what a French paper calls the present war, and the reason is given in an article under that title. *Nature's Submarines* tells of the dangers that beset ships on our shores, and what is being done for their protection. It is illustrated by a number of excellent photographs. *Cider Apple Jelly* is a technical exposition of a manufacture that should be of interest to many people this fall. *Electric Power Diagram* describes a method of building a very significant relief map that shows graphically the work done by an electric light or power plant. The article is accompanied by a number of pictures and diagrams that fully explain the system. *The Principal Bridges of the World* compares the size, importance and principles of design of a large number of notable structures. Other articles of interest are *Testing a Light Filter; The Moons of Mars; The Men Who Build Our Ships; Substitutes for Glass* and *Instruments for Air Use.*

How the Hindoo Juggler Catches Fish from the Air

(*Continued from page 349*)

he also pulled the fine line with his other hand, so as to release the catch at the bottom of the float. As the float opened, he let go the subsidiary line, and the fish slipped by its own weight down the rod to the level of the hook. The longer the rod, the further from the spectators will the fish appear when it is "hooked"; while the real movement of the fish toward the hook is disguised by jerking the hook back toward the place whence the fish came. The fish reached the latitude of the hook very accurately—the fine line is measured off in advance with the greatest care to insure this. When the assistant has unhooked the fish—at once—and the trick rod has been taken out of sight, there is no opportunity for the spectators to discover that the fish was not attached to the real hook, but merely hung beside it.

Of course, the spectators will be convinced that they have witnessed a trick—they will not believe that the fish was materialized out of thin air. But the crafty performer has given them no chance to detect the nature of the imposition. The audience does not know that the fish employed must always be of the same species—a hardy creature that will live with very little moisture for half an hour or so. Inside the float it gets this necessary moisture from a wet sponge fixed just above its gills. If, when the climax of the trick was reached, there were a shower of water simultaneously with the appearance of the fish, this might seem in keeping to some minds, but the average spectator would probably connect it with the float and at once reach the conclusion that the fish and the water came from inside. But the mind will be reluctant to place the fish inside the float after a perfectly dry performance; so the trick mystifies to the complete satisfaction of all concerned.

Baedeker as an Office of Military Intelligence

(*Continued from page 354*)

One of the most expansive editions was that of Egypt which was to have become a German Protectorate if only the program of conquest had worked properly. It was the boast of the Baedeker family that each book was thoroughly recast every few years and the pages were kept permanently standing on moveable type.

A colossal sum must have been expended in visiting and revisiting the districts and it is doubtful whether the sales, big as they were, allowed sufficient margin to meet all the vast expenditure. Possibly, like many other German enterprises promoted to expand the power of the Fatherland, it was heavily subsidized. Certainly no other publication could compete with it.

The maps were marvels of accuracy and detail. Not a railway however small in Europe or Asia but was shown, and any developments were faithfully recorded in the editions that were so kept up to date, that by August, 1914, Baedeker could be implicitly relied upon to show the way to the invading German hosts.

But the crowning achievement of the Baedeker family was to have been the guide books to the new German Empire, comprising most of the old world and the new, which would have been brought out by now, if only things had gone as the German General Staff had planned.

With Scalpel and Drug

(*Continued from page 355*)

classes of the 57 coëducational and medical colleges for women. It also is enlisting the interest of women physicians for service in industrial plants.

We are accustomed to think of war medical and surgical work as meaning only the care of wounded or the nursing of those taken sick while on active duty. While these activities of course are the immediate and vital ones, there are others only less important in that they are "over here" and not "over there." Among these are industrial medicine and surgery, and a committee with that title has done valiant work in this necessary field.

The pressure of production in factory, farm and mine has produced health and social problems which must be solved by the medical profession. Proper food and housing and the sanitation of industries are war equations.

The committee recognizes that the state of war makes it imperative: To provide against unnecessary human waste in industry during the war; to offset the drain of man power caused by the raising of military forces; to meet the need for greatly increased production; to avoid preventable deaths and disabilities from accident and disease; to restore to full producing power in the shortest possible time sick and injured workers; to increase output by keeping workers in good health; to provide healthful places in which to work; to provide healthful homes and communities in which to live; to meet shortage of medical service induced by military needs.

The Red Cross has made the subject of nursing a familiar and a loved one among readers, playgoers and motion picture audiences. But rarely does the public appreciate what a real nurse really is. It is not sufficient to put on a pretty uniform and "sooth the sick and fevered brow." A nurse, to be worth the room she occupies in a military hospital, must be a graduate, a trained and highly educated product of a hospital training school. And, both because other vocations offer greater financial advantages, and because of the rigors of training, by no means all training schools are running to capacity.

This is one of the problems taken up by the Committee on Nursing, which has made a comprehensive survey of the nursing situation for the Army, Navy, Public Health Service, and American Red Cross with the result that our nursing resources are coördinated in such a way as to be of greatest value to the military medical departments.

In addition to instituting an educational campaign aimed to interest young women in nursing as a career in order that they might upon completion of their training fill institutional positions, thereby releasing trained nurses for duty with the fighting forces, the committee has made a direct appeal to graduate nurses to enroll in the Army, Navy and Red Cross Nursing Services.

Statistics gathered by the committee show that 98,162 graduate nurses will be available at the close of 1918 and that there are 50,000 girls now in training. But a large proportion of those who enter training never finish.

The committee is now completing plans for a campaign to fill the classes of every accredited training school.

The committee recommended that accredited training schools giving a three years' course crowd forward the theoretical instruction and hold final examinations and graduation exercises as early as possible in 1918, and release their graduates, providing the Government needed them and they would enter directly into government service. It has also authorized an intensive preparatory course in nursing for college graduates at Vassar College during the summer, open only to women who have previously registered with an accredited training school for nurses, for an additional two years of regular nurses' training.

Recommendations, approved by the Army and Navy Nurse Corps, have been addressed to the Surgeon General of the Army and favorably received by the Surgeon General and the Secretary of War, to the effect that houses be rented and transportation to the nearest town be provided when necessary to accommodate the nurses in lieu of available tents, barracks, or other temporary shelter; that a regular quota of not less than one nurse to six acutely ill men be provided; and that a reserve of not less than 25 over the prescribed quota be stationed at each hospital to meet emergencies and secure special training in the military establishment.

It is well realized that the work of the General Medical Board of the Council of National Defense is much too large for the purpose of a magazine article. A thousand interesting details are omitted from men-

(*Continued on page 366*)

RECENTLY PATENTED INVENTIONS

Pertaining to Apparel

HELMET CAP.—F. B. BIGGS, 133 W. 71st St., New York, N. Y. Among the principal objects which the invention has in view are, to provide an article of wear in the form of a cap, constructed from two pieces of material, adapted to be worn in various forms, such as an ordinary cap, or when desired to cover the back of the head, ears and neck, and to produce a neat and presentable article on the head.

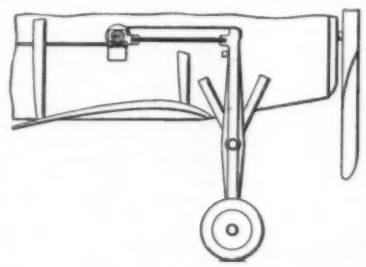
SHOE TONGUE PAD.—R. A. FOX, 100 St. Nicholas Ave., New York, N. Y. Among the objects of the invention is to provide a comfortable device for the purpose of effecting a proper fit of laced shoes at the instep and ankle. Other objects are to provide means whereby a shoe too loose at the instep or ankle may be easily padded to fill out the unsightly part, and to provide means whereby the eyelets will be kept from hurting the foot or ankle.

WRIST MITT.—F. B. BIGGS, 133 W. 71st St., New York, N. Y. Among the principal objects of the invention are to provide a covering which protects the hand while affording free play for the fingers. The device comprises a full length back portion, and an abbreviated palm portion extending to the base of the fingers, a flap shaped in correspondence with the end of the back portion for supplementing the palm portion in covering the palm of the hand.

WARMER FOR FOOTWEAR.—W. W. LILLARD, care of E. J. King, 274 Monticello Ave., Jersey City, N. J. The object of the invention is to provide a foot warmer such as can be used by aviators, drivers of street cars and automobiles. To accomplish the result use is made of an insole for removable insertion in a shoe, an electric heating medium embedded in the insole, electric conductors extending through the heel, and sets of contacts in the heel and insole in detachable engagement with each other, and in connection with the conductors.

Pertaining to Aviation

RUNNING GEAR FOR FLYING MACHINES.—G. C. MOORE, Moore Rd., Westerly, R. I. The invention relates to swinging running gears for flying machines, it is characterized by means whereby the running gear may be rendered rigid with the flying machine or yielding relative thereto. An object is to provide a simple and efficient running gear which will permit an easy starting and a safe landing.



FRAGMENTARY SIDE ELEVATION OF MACHINE PROVIDED WITH INVENTION

OHM METER.—H. G. STUART, 412 E. 33d St., Paterson, N. J. The invention relates to electrical measuring instruments, its general object is to provide an instrument which embodies an ammeter and a volt-meter arranged in a special manner and having respectively a movable dial and a hand or indicator so correlated to the dial that by means of the two it is possible to read directly the resistance of a conductor to be measured.

Of Interest to Farmers

FENCE WIRE STRETCHER.—R. E. L. FREESE, Franklin, Mo. The object of the invention is to provide a wire stretcher in which a winding drum or windlass and wire rope are employed in connection with means for attachment of the apparatus to a post or tree trunk. The device comprises a tubular body and a ratchet bar adapted to slide therein, a lever pivoted to the body having a pivoted feed and locking dog engaging the ratchet and means attached to the body and adapted for engaging the free emd of the lever.

Of General Interest

TRANSPARENT COLLAPSIBLE BOTTLE OR OTHER CONTAINER.—A. C. CRUMP, 20 W. 50th St., New York, N. Y. The invention relates to containers the entire body of which is pliable or collapsible. The general object is to provide a container of transparent material which will not injuriously effect the contents, which is flexible at the bottom, neck, and throughout the length of the body, so that danger of breakage and loss of contents is obviated, the device is fitted with a non-yielding stopper, whereby an effective seal is made possible.

A VERTICAL SECTION OF THE CONTAINER

ARM ADJUSTING DEVICE FOR DISPLAY FIGURES.—E. T. PALMENBERG, 63 W. 36th St., New York, N. Y. The invention relates to display figures of wax or other materials, its object is to provide an arm adjusting device, to facilitate dressing and draping the figure and to give any desired pose to the arm. Another object is to permit the manufacturer to separately manufacture the body and the arms and to allow convenient packing and safe shipping of the figure with the arms detached.

TEXTILE FABRIC.—C. E. KALTENBACH, Thomas and Cummings St., Cranford, N. J. The invention has particular reference to a fabric which may be regarded as composite with respect to its assemblage or construction, one which is intended to resist breakage as a result from strain. Among the objects is to provide a strong light fabric adapted especially for use as a covering for aeroplane wings, kites or other uses which demand that a fabric shall be practically air tight and waterproof.

WINDOW CONSTRUCTION.—S. B. ZIMMER, El Centro, Cal. A specific object of this invention is to provide a window construction in connection with which a screen may be utilized in such manner as to effect simultaneous movement

AN ELEVATION OF THE SASH FRAME, SASHES AND SCREEN

of the two sashes and the screen, bringing the latter into operative position, as the sashes are opened, and in connection with which the screen is moved as the sashes are closed so as to leave an entirely free lower sash without obstruction of view.

HAM BOILER.—H. ADELMANN, care of Ham Boiler Corporation of N. Y., 405 Lexington Ave., New York, N. Y. This invention relates to meat cooking appliances, and has particular reference to ham boilers of the general type covered by Letters Patent, 1,202,637, Design No. 49,915, and Patent 1,206,494, issued to the Ham Boiler Corporation. Among the objects of the present invention is to render a ham boiler more convenient with respect to the manipulation of meat and with respect to means for inserting and removing the meat.

SHIPPING TAG.—C. P. KLEEDAUER, 150 Nassau St., New York, N. Y. Among the principal objects of the invention are, to prevent tearing the tag in service, to facilitate the application of a tying string to the tag, and to reduce the cost of manufacture of tags. The device comprises a plurality of layers of material, each having a partially severed section, each section having formed therein an opening, the entrance to the openings of the sections being extended in relatively opposite directions to avoid alinement when the sections are adhered, and means for uniting the sections to form a unit structure.

TRAP.—A. E. LYCAN, R. R. No. 1, Box 20, Kooskia, Idaho. The object to this invention is to provide a trap for catching mice and rats, the trap being constructed with a tilting bottom which may be secured in position and over which the mice may safely pass to the bait compartment, which they may visit for a sufficient period to make them familiar with the trap, after which the tilting bottom may be freed and a glass panel disposed between the end of the tilting bottom and the bait compartment with the result that the animal will fall into a compartment disposed below.

DISH.—L. R. POSCHADEL, 155 Garfield Ave., Milwaukee, Wis. The invention has for an object the provision of a soup dish or receptacle wherein all the contents may be removed without tilting the dish. The dish comprises a body formed as a bowl structure with a depression therein adjacent one of the walls, this depression being in free communication with the remaining part of the dish.

A TRANSVERSE SECTION

GOGGLES.—B. W. GAMMON, 462 Bainbridge St., Brooklyn, N. Y. The object of the invention is to provide a goggle or eye shield arranged to completely protect the eyes of the wearer, and to provide a device not liable to be affected by the changes in the weather and prevent precipitation from accumulating on the lenses. In order to accomplish the result the lenses are made of celluloid or similar diaphanous material and are cup-shaped having their walls fitting the walls of the openings in the frame to project the lenses beyond the front face of the goggle frame.

LAMBREQUIN.—J. JARVIK, 892 E. 163rd St., Bronx, New York, N. Y. Among the principal objects which the present invention has in view are, to furnish a simple, efficient and easy method for decorating a window or other opening, to regulate the lateral extension of the members of an extensible lambrequin, and to conceal the connections or lines of junction, between the sections by ornaments.

Hardware and Tools

SELF LOCKING CLIP.—F. D. MOON, care of Am. Bridge Co., 30 Church St., New York, N. Y. The invention relates to building construction and has particular reference to means for attaching corrugated sheets of metal; to metal supports, in the erection of metal buildings. Among the objects is to provide clips for securing the corru-

gated sheets to roof purlins whereby the roofing sheets may be attached rapidly and securely to the purlins and with the minimum amount of danger on the part of the operators.

Household Utilities

TABLE.—J. BUBIC, 39 Richmond Ave., Normandie Park, Cranford, N. J. Among the principal objects of the invention are, to provide means for adjusting a table for service, and to provide simple means for housing the extension members. The table comprises a plurality of slidably connected extension frames, a plurality of leaves pivotally mounted, and means for locking the leaves together when in their retracted position, said means embodying a series of manually operable latches, to lock the outwardly adjacent leaf.

Machines and Mechanical Devices

TICKET CANCELLING MACHINE.—H. LUNDGREN and F. TABERG, address Harry Lundgren, 3338 Elmwood Ave., Oakland, Cal. This invention relates to machines adapted to be used in post office, ticket offices and other places where the canceling of stamps, tickets, and the like is necessary. A specific object is the provision of an electrically operated canceling device which includes a switch so sensitive that it is automatically set into action by contact with the edge of a thin piece of paper, ticket or other article which is to be cancelled.

CHANGE DELIVERING MACHINE.—G. L. COLBORN, 192 Edgecomb Ave., New York, N. Y. The invention has particular reference to means for delivering predetermined amounts of coin for the making of change. Among the objects is to provide a machine having a series of selective keys each bearing a number representing the amount of change that will be delivered when such key is operated. A further object is to provide a master plunger or bar adopted to be locked and when so locked will prevent the manipulation of any of the coin delivering keys or plungers.

HOIST GEARING.—J. DAVIDOFF, 637 84th St., Brooklyn, N. Y. An object of the invention is to provide a portable machine more expecially designed for use on dwellings and like structures for hoisting ash cans and other loaded receptacles out of a cellar onto the sidewalk and to return the empty receptacles to the cellar. Another object is to permit of conveniently removing the hoister after use to be out of the way of passing pedestrians.

ROD BENDING MACHINE.—J. N. REYNOLDS, General Delivery, Cleveland, Ohio. This invention relates to rod bending machines of the type intended particularly for use in bending or shaping reinforcement rods employed in large concrete building constructions. Among the objects is to provide a machine which is simple to handle, yet having facilities for insuring rapidity, and uniformity in the bending of an unlimited number of rods.

EQUALIZING PUMP JACK.—J. B. DUNLAP, 618 N. Bosson St., Tulsa, Oklahoma. The object of the invention is to provide a jack wherein the frame attaches to the casing for holding the jack in alinement with the pump rod to cause the pull to be in direct alinement with the stuffing box to minimize the wear on the rod and box, and wherein a drum is provided for permitting adjustment of the stroke by engaging the line with different parts of the drum.

Medical Devices

IRRIGATING DEVICE.—E. P. FOX, Lake Arthur, La. The invention comprises a container within which is arranged a pump, a hose connected with a suitable irrigating nozzle, said nozzle comprising a hollow ball and a nipple. In operation the nozzle is introduced into the part to be irrigated, and the ball acts as a plug to prevent the outflow of the liquid used, the liquid may be forced into the parts by the pump, and by turning the head of the nozzle the flow may be regulated. There is no direct flow against the parts that might cause injury.

Prime Movers and Their Accessories

CENTRIFUGAL GOVERNOR.—J. J. HERZOG and W. M. MEDLOCK, Mobile, Ala. The invention relates to an automatic spark timer for internal combustion engines. An object is to provide a form of centrifugal governor in which the force exerted by the centrifugal members may be transmitted to a movable part in almost any ratio, depending upon the construction of certain cam portions of the centrifugal members. A further object is to provide a governor of ready control and steady action.

HEATING DEVICE FOR TANK CARS.—G. C. BOWEN, 901 W. 3d St., Coffeyville, Kans. This invention has for its object to provide a device which may be easily installed and which cannot slip or become loose, wherein heat is evenly distributed, and wherein the inlet and outlet may be at the end or sides of the car. The heating pipes are arranged longitudinally of the tank, each pipe consisting of three sections supported by substantially yoke shaped brackets; the pipes are connected to a manifold having an inlet and an outlet extending through the wall of the tank.

Prime Movers and Their Accessories

AUTOMATIC STARTER AND CONTROLLER.—P. D. ERNEST, 335 S. Main St., Ann Arbor, Mich. An object of this invention is to provide a device to be used in connection with gas, gasoline, or oil-driven, electric generating sets, the purpose being to operate the generating sets in such a way as to provide current at the proper voltage when there is a demand for the same, and to immediately stop the generating of current when there is no demand for power. A further object is to eliminate the necessity for use of a storage battery.

Pertaining to Recreation

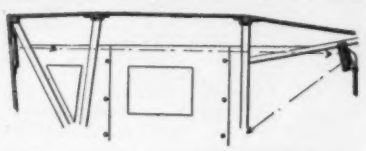
TOY ENGINE.—O. GROVE, 1924 Hovey St., Indianapolis, Ind. The invention relates to a toy characterized by the provision of a paddle wheel against which a fluid may be directed, with means for varying the direction of the impinging fluid so as to change the direction of rotation of the wheel. To change the direction of rotation of the paddle wheel, a movably mounted baffle is provided.

Pertaining to Vehicles

AUTOMOBILE SEAL HOLDER.—S. B. BLAIR, Marquez, Texas. The invention relates to adjustable holders adapted for holding the registry seals carried by automobiles. An object is to provide a spring clamp arranged in such a manner that when it is clamped into a part of the automobile as for instance the radiator tube, a clamping action is also had on the seal, thus holding both in place.

CLEANING DEVICE.—C. A RIDGWOOD, Westwood, N. J. An object is to provide a cleaning device for cleaning the wind shields of power-driven vehicles such as automobiles, and other surfaces liable to be blurred by snow, rain, or dust. Another object is to provide a device which can be readily applied, and one that enables the operator to start the cleaning at any time and allow it to perform its functions a number of times over the same surface, to clean both the outer and inner faces, without the operator being required to pay any attention to the device and without the latter interferring with the running of the vehicle.

ATTACHMENT FOR MOTOR VEHICLES.—R. A. PULLAR, 1219 Wilding St., Portland, Ore. The invention has for its object to provide mechanism in connection with a vehicle for permitting the driver to see following vehicles, by

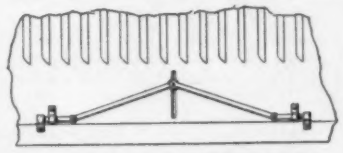


A SECTION OF VEHICLE, PROVIDED WITH DEVICE

means of a mirror arranged at the front of the vehicle. This is accomplished by means of a mirror mounted on the wind shield, the top of the vehicle having an opening at the left upper corner in line with the mirror, a disk of transparent material covering the opening, the mirror and disk being above the heads of the passengers and driver when seated.

SIGNAL FOR MOTOR VEHICLES.—F. F. PARADIS, Lafayette, Col. The object is to provide a signal capable of quick and easy attachment to or detachment from a windshield, and wherein the signal proper is arranged to be extended at either side of the windshield, locking mechanism being provided for holding the signal in either position or in neutral position.

FASTENER FOR AUTOMOBILE HOODS.—B. F. CLINE, 298 Central Ave., Orange, N. J. The invention has for its object to provide a simple, easily operated device, by means of which with a single movement the hood may be locked or unlocked at both ends; the device comprises

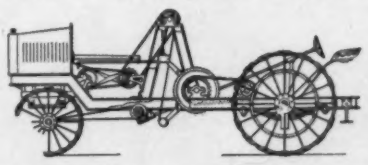


VIEW FROM THE INSIDE OF HOOD

bolts mounted to slide on the inner face of the hood at the opposite ends, a handle is mounted to slide in a vertical slot in the wall of the hood the handle being moved downwardly peress the bolts into engagement with keepers and the hood is locked.

TRACTOR ATTACHMENT FOR AUTOMOBILES.—E. B. WINTERS, 815 Union St., Coffeyville, Kans. An object of the invention is to provide a contrivance which can be easily secured to an automobile without interfering with any part of the body so as to mar it in any way, nor is it necessary to secure the attachment or get under the car when attaching or detaching. Another object is to provide an attachment having an extensible frame, so that it may be easily adapted for cars of various sizes.

DRIVING MECHANISM FOR TRACTORS.—L. M. YAGGY, Bowman, N. D. This invention is applicable to tractors generally and more particularly to a tractor in which the rear axle is driven from a motor mounted on the tractor at



SIDE ELEVATION OF A TRACTOR EMBODYING THE INVENTION

the front. A specific object is to provide a drive means in which ratchet mechanism in driving connection with the driven axle is actuated from the motor by driving means including a system of belts and belt-shifting means controlled by the movement of ratchet levers.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of patentee title of the invention, and date of this paper.

With Scalpel and Drug

(*Continued from page 363*)

tion for lack of space—such as the study of shell shock, of trench parasites (lice), of ear protectors, etc.

But enough has been said to show the comprehensive scope of the work of the Board, and the character of the labor it is doing. Certainly it has filled a need which was sprung upon the country overnight, and made available, to a nation almost entirely unprepared for war, the services of doctor, surgeon, nurse, laboratory assistant and manufacturer of medical supplies, in a far less time than any other existing governmental agency could have done it.

When in addition, it formulates and attacks problems of sanitation, of industrial medicine, of the social and economic status of maimed men, and adds to its labors direct laboratory experiment for the production of better drugs and instruments, and more of them, it is easily seen that its activities are such that neither army, navy, marine corps, nor Red Cross could function properly without its guiding, coördinating and centralizing hand.

A New Source of Vegetable Fat

(*Continued from page 357*)

slatted sides, which allow the free circulation of air through the heap. In a few more days they are ready for the mill.

The nuts are delivered to a bucket elevator which carries them to a hopper above the cracker, close to the roof of the building. This machine is an ingenious device, the invention of the heads of the company, and is being patented in all countries where hard shell palm nuts are of interest. It was illustrated in the SCIENTIFIC AMERICAN for September 29th, 1917.

The cracking machine consists of a huge cast iron bowl, six feet in diameter, containing in its interior a rapidly revolving fan or rotor supported on a vertical spindle. The rotor and its spindle, weighing about six hundred pounds, are so nicely balanced upon roller bearings that when revolving at 1,000 revolutions per minute, no vibration is noticed. The nuts are fed from the hopper through an opening in the center of the rotor and are thrown tangentially by centrifugal force against a circular breaking wall which lines the upper rim of the bowl-shaped casing. The shell is cracked and the particular shape of the circular wall deflects the nuts and shell downward and out of the way of the oncoming nuts. The mass of shell and kernel fall through an opening below to a separating device which takes out the major portion of the shell and delivers it to a conveyor leading out of the building to the shell pile. The kernel and a small portion of the shell are delivered by gravity to a slowly traveling picking belt. Native women, stationed at intervals along the belt, pick out the kernels and drop them into a chute. The kernels, after a short preliminary drying, are sacked for the market.

The plant has a capacity of 40 tons of nuts per day and is operated by steam—a 35-horse-power engine and boiler supplying the power. A small portion of the shell from the nuts serves as an admirable fuel, almost equal to coal, and costs practically nothing. Experiments made by the company to use this fuel for the manufacture of producer gas have proved very successful. Gas producers will be installed in the tow boats to utilize the shell in place of costly fuel oil.

Physically the cohune oil has the same general appearance, color, odor and taste as the palm oil which has already won its place in commerce. They are being used interchangeably for the same purpose, namely, in the manufacture of fine soaps and of nut butters. This latter industry has increased enormously in the United States in the last two years. Government statistics show an increase in consumption of these oils as the chief ingredient of nut butter, during the past 12 months, of over nine hundred per cent. One manufacturer alone uses 40,000 pounds daily in his butter factories. When we learn that in 1916 the United States imported over 46,000,000 pounds of palm and palm kernel oil, of an aggregate value of $3,400,000, we will be able to formulate some idea of the size of the industry. Indeed, of all expressed vegetable oils we bring in about $20,000,000 worth each year; and the portion of this field which is not subject to invasion by the cohune product is a small one. The cohune oil is entirely digestible and highly nutritious, making it particularly available for use in foodstuffs.

Since the United States entered the world war, several large concerns are preparing themselves for operations in the field of palm kernel production in Central America; and this undoubtedly means that in the near future the forests of the tropics will help solve the serious question of a shortage of fats in the United States. The chief obstacle in the way of utilization of the cohune has been overcome in the cracking machine described. To the question whether there is a sufficiency of this nut to be had to make it worth while for harvesters and refiners to pay it serious

attention the answer is an emphatic yes. It is not as though the growth of the plant depended upon human agency, nor yet as though it were exposed to human destruction. The ground on which it now grows is available for no other use; and if demand should show indications of outrunning supply, it would be possible to plant 100 square miles in cohune trees, which in seven years would be in full bearing.

Spanish Influenza

(*Continued from page 356*)

relatively simple procedures. Hunger, fatigue, a sudden change in the weather, may be sufficient to turn the scale and cause a normally resistant individual to become susceptible to an infection. As an example, may be cited the classic experiments of Pasteur, "father of bacteriology," who showed that by the simple procedure of chilling it in cold water, he could render the naturally resistant hen exceedingly susceptible to anthrax.

(2) Virulence of the germ.

Just as the resistance, or defending power, of the body, is not constant, but is always subject to natural or artificial change, so do we find that the virulence of bacteria, that is their power of invasion and wreaking of injury to the body, varies. Not only do we find certain kinds of germs which uniformly are more virulent than others, but we know that there are often different strains, or races, of the same kinds of germ, which differ greatly in their ability to injure the body after they have gained entrance to it. Moreover, it has been determined that the virulence of many germs can be increased or decreased (exalted or lowered). Most germs lose in virulence when grown outside of the body for a long time. Conversely, many germs gain in virulence when passed successively through the body of a susceptible animal. The streptococcus and pneumococcus, the germs which have been noted as being associated with the influenza bacillus, have been shown to gain in virulence when passed successively through the bodies of a series of white mice, an animal very susceptible to the germs.

The bearing of the preceding upon a possible explanation of the severity of the present epidemic of influenza is as follows. Remembering that any given infection is an interplay between body resistance and injury wreaking powers of a given germ, we may offer some such hypothesis as this. This present pandemic of "grippe" originated probably in Spain, and thence spread rapidly over nearly all of Europe, including the warring nations of England, Italy, France and Germany, in which from 30 to 40 per cent of the people were attacked. Because of the abnormal conditions incident to war, not only as regards food, exposure, etc., but also as regards the congregating of large numbers of individuals within relatively limited spaces, we can perhaps picture the situation in this way. The bodies of certain individuals whose resistance was lowered by the vicissitudes incident to war, may have offered a particularly favorable breeding place for the germs which set up influenza. The congregation of large numbers of individuals within camps, munition factories, etc., afforded the most ideal conditions for the spread of these germs. During their passage through a large number of individuals their virulence may have become raised and possibly this increased virulence of the attacking germs may be the main reason for the severity of the symptoms as manifested in the United States. A certain air of probability seems to be lent to this by the fact that the resistance of the individual does not seem to be a dominant factor with us, because Spanish influenza seems impartially to attack the weak and the strong.

It may be a case of "strong" individuals being attacked by still "stronger" germs, which acquired their high degree of injury wreaking power by first passing through the bodies of a large number of somewhat weakened, and hence more susceptible individuals in Europe.

Artillery Which Keeps Pace with the Infantry

(*Continued from page 353*)

On August 8th last, General Haig's legions moved forward after a short or "crash" bombardment, in company with hundreds of tanks. Again the Germans were completely surprised, and did not have time to bring up reinforcements. At other points the numerous tank fleets of the Allies permitted Marshal Foch to strike sudden and unheralded blows, until the Germans, greatly weakened in manpower, morale and gun-power, were confronted with a more or less continuous offensive along a 250-mile front, such as is raging at this writing.

Thanks to the vast number of tanks at their disposal, the Allies in the fighting up to date have employed but a fraction of the men the enemy has been accustomed to employ for similar offensives. Fewer tanks are now being knocked out as a result of the vast numbers of them engaged. It is said on good authority that a German anti-tank gunner can deal with

one or two, perhaps, but he is simply overwhelmed with dozens coming from all sides. And while it is commonly believed that a direct hit by a shell spells destruction for the tank, there are instances on record where tanks have been hit as many as seven times by 77 mm. shell, without being put out of action.

The present tank fleets of the Allies are the answer to the tens of thousands of machine guns used by the German rear guards, and such barbed-wire entanglements as are encountered. Thirty-six tanks, or one battalion, save at least 1,000 casualties every day they are in action. Like nothing else in this war, the tank has proved the one great mechanical and military surprise, and has brought the most brilliant successes to its originator, the British, and their allies.

Textile and Paper From Pipe Needles

A SAXON company has recently patented a discovery which is of great interest and value in connection with the textile industry; they have succeeded in obtaining a useful substitute for cotton and jute from pine needles so that a very promising future is opened up for German industry both now and after the war. The needles are first of all rendered chemically soluble and then thoroughly mixed by mechanical means, whereupon the fibrous material thus obtained can be spun on any ordinary cotton spinning machine. The thread obtained possessed, in comparison with paper yarns, the advantage that it is flexible and will not break. So far only sacking, floor-clothes, dusters, dishcloths, etc., have been made from the new fiber. But recently very satisfactory results have been made in the production of fine yarn counts. Treated suitably the needles also yield an excellent substitute for leather from which both uppers and a very pliant watertight sole can be made.

In addition, at the Munich Biological Institute some very interesting experiments have been made in connection with the technical utilization of waste wood, pine needles and the like. It has been found that pine needles are highly suitable for the manufacture of a yellowish-brown somewhat thin but tough packing paper. If the needles are fresh fallen they will also yield oil and, during the early weeks of spring, sugar may likewise be obtained from them; albumen may also be extracted from the needles, and the residue can then be used for the manufacture of paper. It may be interesting to note that, in times of stress during the 17th century, similar successful experiments were also made in England; they were not, however, introduced on a large scale into practical use, because the scarcity of paper was soon obviated by means of importation from foreign sources. Germany's wealth in pine forests, and the urgent need of paper existing in that country, are factors that are again drawing attention to this new raw material and modern German technical skill will be in a position to obtain far better results from this raw material than were possible in those earlier times. Steps are already being taken to collect pine needles for purposes of manufacturing on a large scale.

The Land of the Ersatz

WHAT little technical information filters through from Germany continues to consist more and more of discussion of substitutes. Among the latest novelties is a really good and useful material to take the place of the jute which is wholly missing from German trade today. This is "textilit," a mixed product, the result of twisting together a paper and a fiber thread. It contains a very small percentage of long fiber, yet has proved itself a full substitute for linen and jute. Weaving and sewing yarns, webs of all sorts, and bags, are made from it. The uninitiated cannot distinguish these articles from the old ones of jute or linen. Through the admixture of true fiber material there has been attained a decidedly greater firmness than was the case with pure paper fabrics. Already 23 manufacturers of the new textile have formed a protective association, and are looking forward confidently to a continued trade after the war.

An interesting sidelight upon the growing lack of all standard textiles in Germany is furnished by the following official notice from a Bavarian paper:

"The local offices for the examination and issue of purchase certificates can from now on issue purchase certificates for bed linen, for the materials wherewith to make the same, or for bed ticking, only to sick persons against a doctor's certificate. Other applicants must be directed to buy paper-yarn products, which are to be had without purchase certificates. It is furthermore forbidden to make a business of working up woven and knit materials into upholstered goods, especially mattresses."

We have already mentioned in these columns the use of nettles as a textile. In addition to the customary pay for collecting, the Nettle Cultivation Society of Berlin gives to all nettle collectors who deliver 22 pounds of dried stems to the Society, a roll of black or white sewing thread made of mixed nettle yarn.

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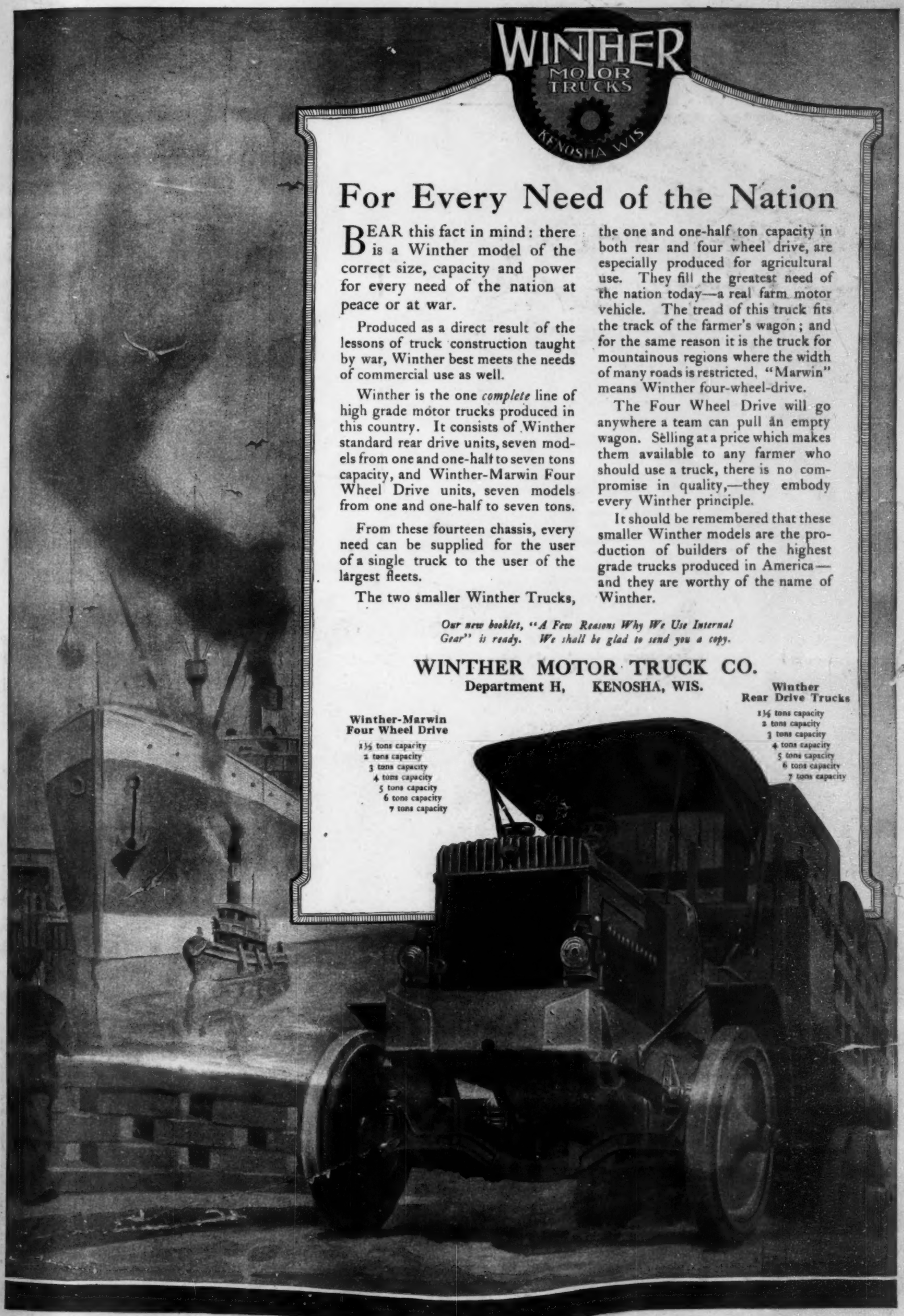

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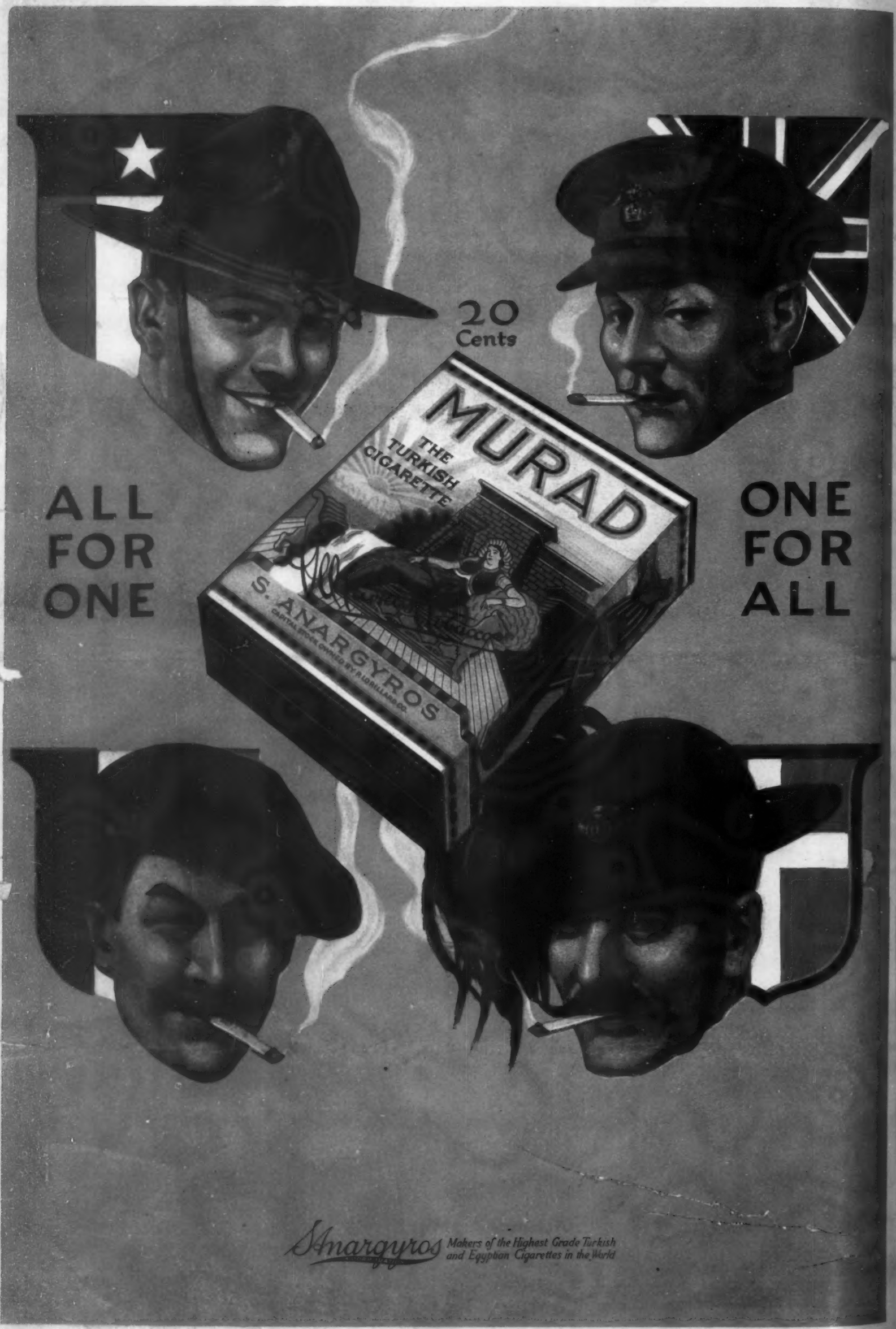
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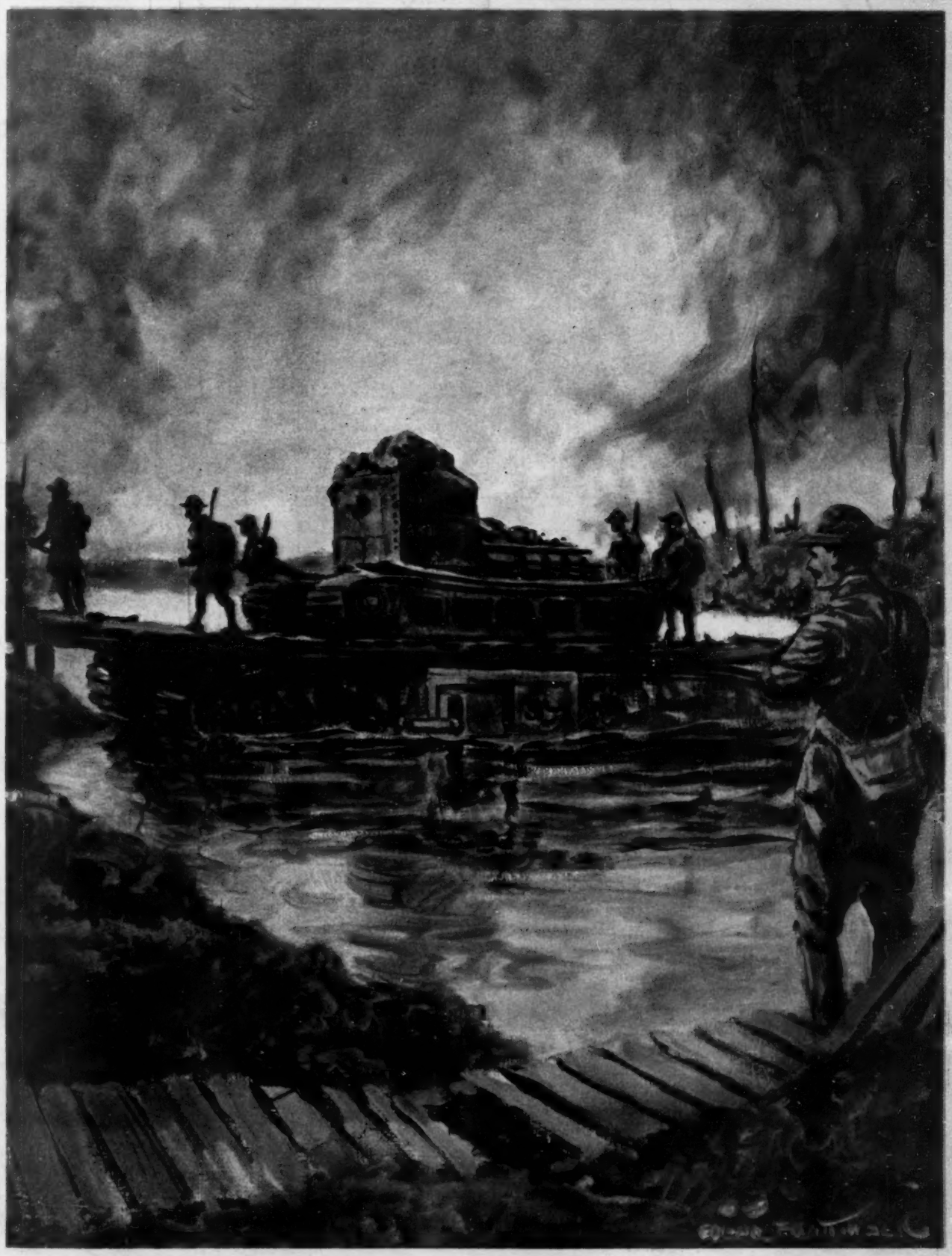

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